BRAIN.

JULY, 1880.

Original Articles.

ON THE FORM AND TOPOGRAPHICAL RELATIONS OF THE CORPUS STRIATUM.

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In the annals of the Anatomical and Surgical Society of Brooklyn, New York, for January, 1880, I gave a résumé of the main features of structure of the brain, as now generally understood by cerebral anatomists, together with a special description of the corpus striatum. These two subjects have a necessary connection with each other, since the corpus striatum is found, on examination, to reproduce very nearly the general curvilinear arrangement of the cerebral convolutions. The description here given of its special configuration is mainly in the form of a transcript from my former article.

If we leave out of consideration for the present the cerebellum and some of the smaller collections of grey matter in the cerebrum, the structure of the cerebro-spinal axis, according to the ideas now in vogue, may be simply described as follows:—The grey matter of the spinal cord, surrounding its central canal, is continued upward on the floor of the fourth ventricle and around the aqueduct of Sylvius. This continuous layer is the "grey matter of the medullary canal," and from it all the cerebro-spinal nerves of motion and general sensibility take their origin. It is connected by longitudinal tracts of white substance with the parts above; and these

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longitudinal tracts, under the name of the crura cerebri, reach a second division or deposit of grey matter at the base of the brain, known as the corpus striatum and optic thalamus, or the "cerebral ganglia." The ascending fibres of white substance pass through and between these ganglia in the form of a fan-shaped layer, the "internal capsule;" and from its upper border they emerge into the diverging expansion of the corona radiata, to reach finally the third and largest mass of grey matter, which is spread out in the convolutions of the cortex.

In this diagrammatic schedule of the structure of the encephalon many things of course are omitted; such as the transverse commissures, connecting similar parts of the two hemispheres, and the antero-posterior tracts, connecting different parts of the same hemisphere. The question whether some fibres of the crus cerebri and internal capsule may not be continuous, from the spinal cord to the cerebral convolutions, is also left untouched. But for our present purpose the above account will represent sufficiently well the relations of the white and grey matter in the cerebro-spinal system.

The spinal nerves and nerve-roots connect the peripheral organs with the grey matter of the medullary canal. The columns of the cord and the crura cerebri connect this nervous centre with the cerebral ganglia; and from the cerebral ganglia the fibres of the internal capsule and corona radiata are the organs of transmission to the cerebral convolutions. Thus the intermediate station or deposit of grey matter, between the cerebral convolutions above and the spinal cord below, consists of the corpus striatum and the optic thalamus.

Of these two bodies the optic thalamus is the more homogeneous in appearance, since the white fibres which penetrate it rapidly separate from each other, giving to the ganglion a comparatively uniform light grey tint. The whole of the thalamus, furthermore, lies on the median side of the internal capsule. On the other hand, in the corpus striatum the fibres run, for the most part, in distinct bundles to within a short distance of its outer border, giving it the visibly striated appearance to which it owes its name. Moreover, this ganglion is split almost completely into two portions by the internal capsule, which lies between them. As the internal

capsule is directed obliquely from below upward and from within outward, one portion of the ganglion lies inside and above it, the other outside and below it. The former is the *intraventricular* portion, or that which is visible from the cavity of the lateral ventricle. It has a club-shaped extremity, or head, directed forward, and a slender continuation, or tail, directed backward; whence its name of the "caudate"

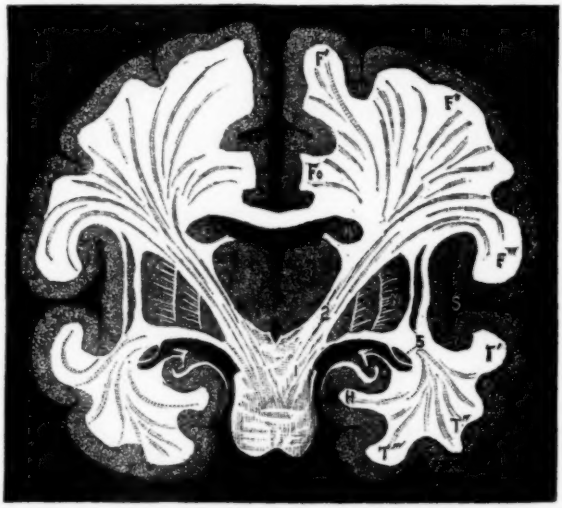

FIG. 1.—DIAGRAM OF BRAIN IN TRANSVERSE VERTICAL SECTION.

1. Crus cerebri.
2. Internal capsule.
3. Optic thalamus.
4. Corpus striatum.
5. Surcingle.
L. N. Lenticular nucleus.
S. Fissure of Sylvius.
Fo. Gyrus fornicatus.
F'. First frontal convolution.
F''. Second frontal convolution.
F'''. Third frontal convolution.
T'. First temporal convolution.
T''. Second temporal convolution.
T'''. Third temporal convolution.
H. Gyrus hippocampi.

nucleus. The other portion, not being visible from the ventricle, but covered by the internal capsule and imbedded in the substance of the brain, is known as the *extraventricular* portion; or, from its lens-like figure, the "lenticular" nucleus. It is now customary to confine the term "corpus striatum" to the first or intraventricular portion of the ganglion. This is

the part to which my observations especially refer, and which I shall describe under the name of corpus striatum. The remaining portion is designated only as the "lenticular nucleus."

The relations of the parts above enumerated may be shown by a vertical and transverse section of the brain, as in Fig. 1. This figure is a diagrammatic one, but it indicates the general direction of the fibres of the crus cerebri, the internal capsule, and the corona radiata. It is also seen that both the optic thalamus and the corpus striatum are above and on the inner side of the internal capsule, while the lenticular nucleus is outside and below it. This nucleus, as is well-known, is divided by thin laminæ of white substance into three nearly concentric layers or zones.

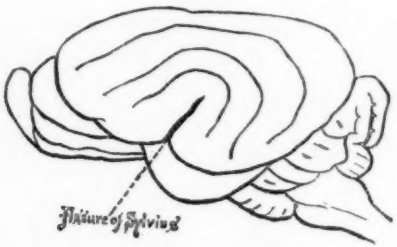

FIG. 2.—BRAIN OF FOX (PROFILE VIEW).

The outer surface of the brain, on the other hand, formed by the convolutions of the cortex, is directly connected with central ganglia. The external configuration of the hemisphere shows that all its convolutions are grouped round a point corresponding with the internal capsule and the lenticular nucleus. This is most distinctly visible in such a brain as that of the fox (Fig. 2), which is marked only by a few simple and parallel convolutions. The constant and deeply marked fissure of Sylvius runs upward and backward, forming the line of division between the frontal and temporal lobes; and all the convolutions on the convexity of the hemisphere are curved very regularly around this fissure. They run upward and backward in front of it, encircle its upper extremity, and then return downward and forward to the end of the temporal

lobe. The entire brain has the appearance of being folded, with all its convolutions, about a transverse axis passing through the bottom of the fissure of Sylvius.

In the human brain, Fig. 3, the fissure of Sylvius is equally distinct, and it is easy to see the same general arrangement of the convolutions running round its upper extremity. The three frontal convolutions pass upward and backward on the convexity of the hemisphere, and the three temporal convolutions run downward and forward, as in the fox, beneath the

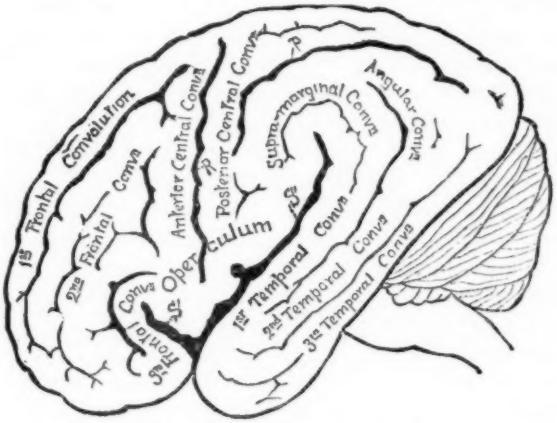

FIG. 3.—HUMAN BRAIN (PROFILE VIEW).

S'. Fissure of Sylvius, anterior branch. R. Fissure of Rolando.
S''. Fissure of Sylvius, posterior branch. P. Interparietal fissure.

fissure of Sylvius. But in the human brain, as compared with that of the animal, there are two new features. In the first place, the fissure of Sylvius is double. There is an anterior branch and a posterior branch, and included between them is a triangular-shaped portion known as the "operculum." Secondly, in addition to the fissure of Sylvius, and above it in position, there is another deep fissure, running in a nearly vertical direction from above downward, on the side of the hemisphere. This is the fissure of Rolando. It is accompanied by two convolutions having a similar direction, one in front and one behind, the "anterior and posterior central

convolutions." The fissure, with its accompanying convolutions, seems to cut across the general direction of the curvature nearly at right angles, and consequently to introduce a certain degree of confusion into the plan of the cerebral hemisphere. But this is only an appearance. It is due simply to the greater development, in man, of the cortical substance.

At the bottom of the Sylvian fissure, the side of the brain is occupied by the convolutions of the *insula*, or "island of Reil." The insula corresponds in position with the outer surface of the lenticular nucleus, and it is that part of the cortex of the brain which is in most immediate proximity to the cerebral ganglia. Externally it is concealed from view, because that portion of the cerebral hemisphere included between the two branches of the Sylvian fissure projects downward from above, and overhangs it like a cover. It is for that reason this portion is named the "operculum;" and when the two branches of the Sylvian fissure are opened, and the operculum between them lifted up, the insula, with its convolutions, is exposed at the bottom of the cavity.

It is evident, therefore, that the fissure of Rolando is not really an interruption to the general run of the convolutions. In the fox the fissure of Sylvius is single, and the convolutions are folded upon themselves only once. But in man the fissure of Sylvius is double, and the convolutions are folded upon themselves twice. The development of the cortex in the human brain is so great that different parts of it overlap each other. The operculum hangs down over the insula. The longitudinal convolutions, instead of running in a continuous curve from before backward, make, about the middle of their course, an additional crook. They turn downward along the anterior branch of the Sylvian fissure, and again upward along its posterior branch. In that way they form the operculum. The anterior and posterior central convolutions are the parts immediately folded upon each other in this downward angular bend; and the dividing line between them is the fissure of Rolando.

The median surface of the hemisphere, Fig. 4, shows a very similar arrangement of its convolutions; the central one, known as the "gyrus fornicatus," being continued, in an

arched or vaulted form, around the end of the crus cerebri, the internal capsule, and the cerebral ganglia. It starts from the inferior part of the anterior lobe, just in front of the Sylvian fissure. It turns up round the anterior extremity of the corpus callosum, and runs along its upper border. Here it is included between the corpus callosum below and the fissura calloso-marginalis above. It extends backward, in this part of its course, as a single independent convolution, as far as the ascending branch of the fissura calloso-marginalis. There it makes one or two connections with the præcuneus,

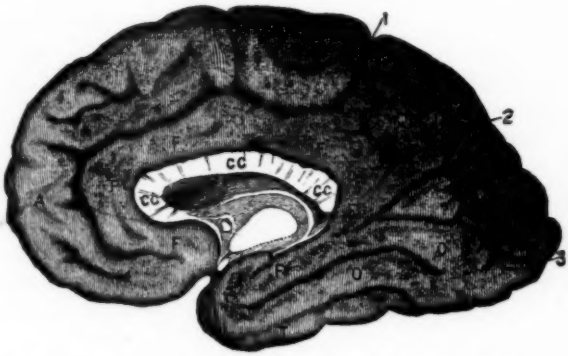

FIG. 4.—HUMAN BRAIN; MEDIAN SURFACE OF THE RIGHT HEMISPHERE.

A. First frontal convolution.
F. Gyrus fornicatus.
P. Paracentral lobule.
Q. Lobulus quadratus, or Præcuneus.
C. Cuneus.
O', O''. Occipito-temporal convolutions.
T. Third temporal convolution.
c. c. Corpus callosum.
1. Fissura calloso-marginalis.
2. Fissura parieto-occipitalis.
3. Fissura calcarina.

and farther back with the cuneus also. It then curves round the posterior extremity of the corpus callosum, passes beneath the crus cerebri, and runs downward and forward to a point just behind the fissure of Sylvius, almost exactly opposite the place from which it started. In this lower portion of its course it is often designated as the "gyrus hippocampi;" and it in fact forms the hippocampus major by the inflection of its grey matter in the inferior horn of the lateral ventricle.

The final destination, therefore, of the fibres of the internal capsule and the corona radiata is the grey matter of the

cortex. That part of the cortex nearest the cerebral ganglia is the insula; and all the rest of the cerebral convolutions are arranged, in a more or less continuous curve, around this spot. All these points are tolerably well known, and receive the general assent of anatomists who have paid particular attention to the brain.

But there are some features in the form and topographical relations of the corpus striatum which are not so well understood. By the term corpus striatum, as already mentioned, we now designate only the intraventricular nucleus of the ganglion, or that which lies above and on the inside of the internal capsule. It is usually described as consisting of a thick or club-shaped portion directed forward, and a slender tail-like extremity directed backward, which runs along the outer edge of the lateral ventricle, and terminates somewhere about the posterior border of the optic thalamus. In reality it is much more extensive than this. A few writers speak of it as reaching into or to the inferior horn of the ventricle; but the only ones, so far as I know, who have described it in a really satisfactory way are Gratiolet, Todd, and Ludovic Hirschfeld. The best account of all is that given by Gratiolet, in his 'Anatomie comparée du Système nerveux,' published in 1857. This description is generally ignored by present writers, and it is expressly stated by so high an authority as Henle, in his last edition, 1879, that the tail-like process of the corpus striatum "tapers gradually from before backward, and terminates in a point opposite the end of the optic thalamus." ('Handbuch der Nervenlehre,' Braunschweig, 1879, p. 155.)

On the contrary, the real form of the corpus striatum is almost that of a complete ring. This can often be seen quite distinctly, without further preparation, when the lateral ventricle has been opened completely from the inside, as in Fig. 5. The slender continuation of the corpus striatum may then be traced, throughout its course, by the pinkish-grey colour of its substance, showing through the transparent lining of the ventricle. The body of the corpus striatum grows smaller as it extends backward in the upper part of the ventricle, and soon runs into the well-known tail-like pro-

longation. This prolongation reaches the posterior end of the optic thalamus, curves downward into the inferior horn of the ventricle, and then runs forward again to the anterior extremity of the inferior horn. It thus encircles the crus cerebri and internal capsule with a narrow band of grey matter, like a loop or surcingle; it ends below in the inferior horn of the ventricle, almost exactly opposite the point where it started in the anterior horn, and it repeats, within the cavity of the ventricle, the same folded or curvilinear arrange-

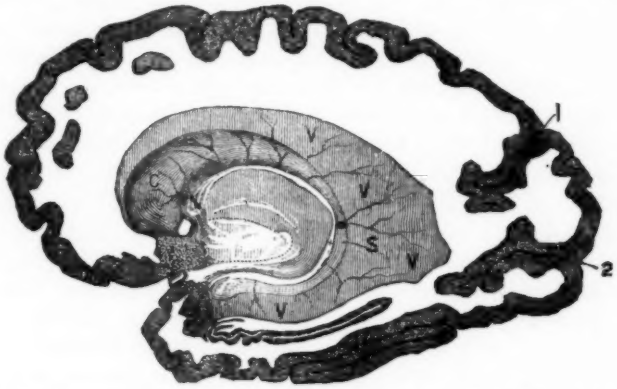

FIG. 5.—LONGITUDINAL AND VERTICAL SECTION OF THE RIGHT HEMISPHERE, SHOWING CAVITY OF LATERAL VENTRICLE (SEEN FROM THE INNER SIDE).

C. Corpus striatum. S. Surcingle. V. Ventricle. A. Amygdala. 1. Fissura parieto-occipitalis. 2. Fissura calcarina.

ment that is to be seen in the gyrus fornicatus and in the convolutions of the cortex generally.

The head of the corpus striatum is not only connected with the lenticular nucleus, but also with the grey matter at the base of the brain, just in front of the Sylvian fissure. The extremity of the surcingle, on the other hand, is connected with a deposit of grey matter forming the anterior wall of the inferior horn of the ventricle. This grey mass is known as the "amygdala." It is sometimes spoken of as an independent nucleus, but it is really continuous with the convolutions of the base of the brain, immediately behind the fissure of Sylvius.

In a view of the ventricle opened from the inner side it is seen that the curved prolongation, or "surcingle," of the corpus striatum is not of the same size throughout. It diminishes considerably in thickness while approaching the end of the optic thalamus, then increases somewhat during its downward curvature, again becomes more slender, and finally terminates at the front part of the inferior horn, in a visibly enlarged extremity. Very often, but not always, it is more or less interrupted near this enlarged portion by one or two bundles of white fibres, which cross it obliquely from above downward. These fibres come from the lower portion of the tænia semicircularis. The tænia semicircularis is well known, in the upper part of the ventricular cavity, as a slender ribbon of white substance, running from before backward along the floor of the ventricle, between the optic thalamus on the inside, and the corpus striatum on the outside. It accompanies everywhere the concave border of the surcingle, following the same curvature downward into the inferior horn of the ventricle, then runs forward along the roof of the inferior horn to its anterior end, and there terminates in the amygdala. It is a little before this termination that some of its fibres are seen to cross the grey matter of the surcingle.

The reason why this annular form of the corpus striatum is not more easily recognized in brain sections is that its two parts are so distant from each other and so variable in size. If a vertical and transverse section of the brain be made somewhat in front of the anterior commissure, it will show the head of the corpus striatum, in that situation, of very large size. In a similar section, passing behind the anterior commissure and through the front part of the optic thalamus, the corpus striatum will appear smaller; and in one passing through the middle of the optic thalamus it will be smaller still. It there begins to present the cut surface, not of the head of the corpus striatum, but of its tail-like appendage. If we continue to make sections farther and farther back, the appendage will at last disappear, and this disappearance will happen about the time the sections pass the posterior end of the optic thalamus. It is this fact, no doubt, which has led to the belief that the corpus striatum comes to an end about the same region. But

in reality it has not done so. It has curved downward in the space left between two successive sections, and has entered the inferior horn of the ventricle, to run forward towards its termination in the amygdala. Sometimes a section will happen to strike exactly the plane of curvature of this part, and will then show a more or less elongated tract of grey matter, running from above downward, a little to the outside of the optic thalamus. In a transverse section of the brain, through the middle of the optic thalamus, the caudate portion of the corpus striatum is visible above the internal capsule and lenticular nucleus (Fig. 1, 4). But there is also a smaller isolated area of grey matter below the level of the lenticular nucleus, and near the outer part of the inferior horn of the ventricle (Fig. 1, 5). Now these two sections, one above the internal capsule, and one below it, are the same thing, or rather they are two different parts of the same thing. One of them is that part of the corpus striatum which occupies the floor of the lateral ventricle above, the other is that which runs along the roof of the inferior horn below. In every section behind this, both these two parts will be visible, until a point is reached a little beyond the optic thalamus, when they will both disappear together.

The same figure shows how other parts of the brain, which are arranged in a looped form, may appear twice in a vertical section. In the brain of the fox (Fig. 2) it is evident that a section made at right angles to the fissure of Sylvius would cut the frontal convolutions in front of this fissure, and also the temporal convolutions, in reverse order, behind it. In Fig. 1 the same thing appears in the human brain. The frontal convolutions above the Sylvian fissure correspond in number with the temporal convolutions below it. In the parietal region their direct continuity is interrupted by the downward curvature about the fissure of Rolando; but still it is perfectly evident that the first temporal convolution (T') is really the end of the third frontal (F'''), the second temporal (T'') of the second frontal (F''), and the third temporal (T''') of the first frontal (F'). The remaining convolution of the temporal lobe, the gyrus hippocampi (H), is the termination of the gyrus fornicatus (Fo). In Fig. 4 the curvature of this convolution

is shown throughout its length. It is plain that, in a vertical section passing through the middle portion of the brain, it would be cut twice; once above and once below the situation of the cerebral ganglia.

It is not very easy to make a longitudinal section of the brain which shall pass continuously through the whole of the ring, or loop, formed by the corpus striatum and the surcingle. All parts of the loop are not exactly in the same plane, either vertically or longitudinally. Its posterior portions are situated

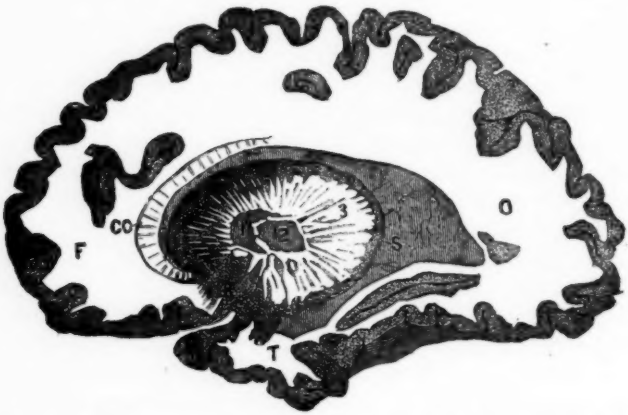

FIG. 6.—LONGITUDINAL AND VERTICAL SECTION OF THE RIGHT HEMISPHERE, THROUGH CORPUS STRIATUM AND SURCINGLE (SEEN FROM THE INNER SIDE).

F. Frontal lobe.
O. Occipital lobe.
T. Temporal lobe.
C. Corpus striatum.
S. Surcingle.
cc. Part of corpus callosum.
1, 2. Middle and internal zones of lenticular nucleus.
3. Diverging fibres of internal capsule.

farther from the median line than the anterior, and its superior and inferior branches are so slender and so widely separated that it is difficult to make a single oblique cut which shall show the whole of both. It can be done, however, by following carefully with the edge of a knife the curved track of grey substance from point to point, until the whole of it is exposed, and then removing the adjacent white substance down to the same level. Such a section is shown in Fig. 6.

It has exposed the white surface and radiating structure of

the internal capsule, and near its centre a little of the internal and middle zones of the lenticular nucleus. Surrounding the capsule is the grey tract of the corpus striatum and surcingle. In the head of the corpus striatum the bundles of white fibres are visible, traversing the grey matter in the form of distinct streaks, or striations, to within a short distance of its outer border. In the slender curved portion, on the other hand, no striations are to be seen, the colour being everywhere of a uniform grey. But throughout this region the radiating fibres of the internal capsule pass beneath the band of grey substance obliquely, from without outward, in the form of distinct bundles; and between these bundles the grey matter of the surcingle dips down, more or less deeply, at irregular intervals.

It is for this reason that transverse sections of this part of the corpus striatum vary so much in apparent size. If the cut happen to pass through a projecting bundle of the internal capsule, the section of the surcingle will appear small. If it pass in the interval between two bundles, the area of grey matter exposed will be considerably larger. From the same cause the sections are often unequal on the two sides of the brain. The projecting bundles of the internal capsule and the gaps between them seldom correspond exactly in the right and left hemispheres; and if they did, we could hardly make a section, either horizontal or transverse, which should follow with entire precision the same plane on the two sides. But, notwithstanding these apparent inequalities and variations, the grey matter is continuous throughout the curved portion of the corpus striatum.

In horizontal sections of the brain, the size and form of the cerebral ganglia vary greatly according to the level at which the section is made. At the level of the corpus callosum only a little of the arched portion of the corpus striatum is exposed, and none of the lenticular nucleus is visible. Somewhat below this, at the level of the fornix, the arched portion of the corpus striatum disappears, but there is a large oval section of its head in front, and a small one of a surcingle behind. Lower still the lenticular nucleus comes into view, separated from the head of the corpus striatum by the dis-

tinctly marked anterior prolongation of the internal capsule. At the level of the anterior commissure, as in Fig. 7, the

FIG. 7.—HORIZONTAL SECTION OF THE BRAIN, THROUGH THE ANTERIOR COMMISSURE AND LOWER PART OF THE CEREBRAL GANGLIA (FROM A PHOTOGRAPH).

a, a. Head of corpus striatum. *b, b.* Surcingle.

lenticular nucleus and the head of the corpus striatum begin to fuse with each other, owing to the partial disappearance of the internal capsule between them. At this level the head of

the corpus striatum, *a*, *a*, is much reduced in size and altered in shape. The lenticular nucleus occupies a position outside and behind it; and still farther back, at *b*, *b*, is the section of the surcingle, which is here beginning to run downward and forward, along the roof of the inferior horn of the ventricle. At a lower section still, the head of the corpus striatum would be united with the cortical convolutions in front of the Sylvian fissure, and the surcingle with the grey substance of the amygdala.

NYSTAGMUS.

BY R. P. OGLESBY,

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NYSTAGMUS is the name of a disease arising from various causes of a distinct and separate character—difficult of generalisation—causes diametrically opposite—causes which on the one hand lead to grave results, on the other hand simple, but lasting in duration.

That it is a disease worthy of careful study is doubtless true, and if symptomatic cases of varied origin are met with, then it always repays the trouble of careful investigation.

I have primarily classed the disease under two heads—the idiopathic and the symptomatic, and afterwards redivided them into local and central.

The idiopathic form of nystagmus depends on a defective co-ordination of the associated movements of the eye, of a character essentially simple in form and not portending any grave result.

The oscillation of the eyeball varies in kind and degree. It may be horizontal (this is the most frequent form met with), or rotary, the eyeballs oscillating round the axis of the oblique muscles. The vertical form is seldom met with, the only case I have seen occurred in a man suffering from disease of the nervous centres.

It is recorded that binocular vision and nystagmus are incompatible, and truly so in the majority of cases; but where vision in either eye is but slightly impaired, the muscular apparatus not very unstable, the two eyes can act perfectly together during strong convergence.

The disease is peculiar to infant life consequent upon

various congenital abnormalities. It is also due in infant life to peculiar constitutional defects which early show themselves.

Idiopathic nystagmus is usually permanent, its causes being as a rule irremediable. It will be well to glance at the local form of the disease named congenital, and subdivide as follows:—

1st. *Albinoes.*—A very interesting form of the disease occurs in Albinoes. Marked examples of the kind were shown by me at a meeting of the West Riding Medico-Chirurgical Society. The subjects are two little boys—brothers—aged 6 and 8 years. Their hair is of a brilliant white; and their eyes, as they moved from member to member in the powerfully gaslighted room, oscillated horizontally with great rapidity. The family history disclosed physiological peculiarities concerning the child-bearing propensities of the mother. In these cases the unstable condition of the muscular apparatus is caused by absence of the hexagonal pigment cells of the choroid.

2nd. *Cataract.*—Lamellar or zonular cataract does not generally cause blindness. The marginal portion of the lens is sufficiently clear to allow rays of light to penetrate. Nystagmus usually accompanies this form of lens mischief.

3rd. *Choroiditis.*—Choroiditis is generally the result of inherited syphilis, and is by far the most prolific source of congenital mischief which causes nystagmus.

4th. *Anomalies of Refraction.*—Viz. myopia, hypermetropia, and astigmatism, are seldom accompanied by a nystagmus. Once or twice in myopes I have noticed this condition, but in these cases the ophthalmoscope disclosed an advanced disease of the choroid.

IDIOPATHIC NYSTAGMUS, ACQUIRED.

1st. *Opacities.*—On the surface of the cornea which implicate a large portion of the area of the pupil. In these cases it is necessary for vision that the eyes should perform rapid horizontal movements to bring the image rays to a focus on the retina.

2nd. *Sympathetic.*—A young man was admitted as an in-

patient under my care for treatment. His case, a somewhat novel one, presented peculiarities worth recording. In his youth he had lost the sight of the right eye from suppuration of the cornea, the result being a shrunken globe. Two years ago he sought the aid of a notorious quack who practises ophthalmology. (?) This man persuaded him to wear a glass eye over the diseased globe. When first seen by me he was still wearing the glass eye, which had produced a condition of sympathetic ophthalmia in the left eye. The pupil was partially closed, and vision limited to shadows. After dispensing with the glass eye, I removed the shrunken globe with great benefit, as vision in the left eye at once improved. In this case there was a very decided nystagmus of the rotatory kind.

With regard to the acquired form of idiopathic nystagmus, examples might with ease be multiplied, but the two cases given are sufficient to show how injury or disease will cause it.

The treatment varies much, and is at the best but of little good. In some cases tenotomy has been vaunted as a cure. I am afraid it is a proceeding of doubtful value. In such cases as are met with in Albinoes, coloured glasses often prove useful; and should the nystagmus depend on an anomaly of refraction —a thing very rare—properly selected glasses are of value.

The prognosis of idiopathic nystagmus is simple, and may be summed up in but few words. It is seldom dangerous and but rarely cured.

SYMPTOMATIC NYSTAGMUS.

Having glanced thus briefly at the idiopathic form of the disease, I must say a few words regarding a much more serious form, usually named Symptomatic Nystagmus. In the first form we have unstable muscular action, due to local causes, not interfering with the general health of the patient, and being more unpleasant than dangerous.

In the latter form we have a disease of central origin, often grave in its prognosis, and either due to unstable grey matter, such as that which will produce the petit mal, or a form much

more serious, as in myelitis or disseminated sclerosis. By far the greater proportion of cases depends upon a condition of irritation rather than direct structural lesion, and by far the greater proportion of cases lasts over a period indefinite in time, so far as clinical observation teaches us. In many instances the symptoms occur in early life and after an acute attack, often so severe as to endanger life, subside and remain passive for a time, afterwards to break out afresh, and so end in the patient's death. Again, nystagmus may be the early and most prominent symptom of undoubted intra-cranial mischief, of a kind that runs its course quickly and early destroys life. In these cases the patients are invariably young, and in many instances the lesion is due to acute inflammation of the base (basilar meningitis).

The etiology of nystagmus has many bearings. In some cases the actual nervous lesion is the sequela of acute febrile attacks. Typhoid fever is not unfrequently followed by serious visual ailments, chiefly—so far as my experience goes—by neuro-retinitis, and less frequently by nystagmus, the two representing a cerebral lesion consequent upon the acute meningitis during the fever. Acute rheumatism is another cause of the disease. Especially is it caused by those cases in which valvular disease of the heart is present. Severe and long-continued mental troubles associated, in the poor, with great privation and often absolute want of food. A case of this kind is at present under my care.

In one case the early cause was severe mental trouble concerning the payment of a large sum of money. The patient, who had a very sensitive and highly organised nervous system, completely broke down under the strain. Symptoms of disseminated sclerosis followed, nystagmus after some months appearing and becoming persistent.

The worst form of nystagmus I have as yet seen is persistent in a boy aged 10 years, and is congenital. The nervous system is ailing generally, and the whole symptoms very undoubtedly point to insular sclerosis, due, I believe, to inherited syphilis.

Pathology points to the following lesions as a cause of symptomatic nystagmus :—

1st. Lesions of sub-ventricular origin.
2nd. Lesions affecting medulla oblongata.
3rd. Lesions specially affecting grey matter of floor of fourth ventricle.
4th. Basilar meningitis.
5th. Miliary tubercle (meninges).
6th. Wounds of brain and medulla.
7th. Hæmorrhage (cerebral).

Epilepsy plays a marked part in the cause of symptomatic nystagmus, and in many cases the oscillation of the eyeballs is constant. This, so far as my experience teaches me, is never seen except in those who suffer from the minor form of the disease. In epileptics suffering from the graver form of the disease, the movements of the globes, although in character the same as in the minor form, are not persistent—commencing and ending with the fit.

A remarkable case of epilepsia gravior associated with nystagmus occurred in a boy aged 13 years, who was suddenly disabled by a sunstroke. When first seen by me as an infirmary patient, he was having as many as ten fits a a day. The aura was most distinct, commencing in the right arm and passing upwards along the neck towards the eye. This was followed by diplopia, and the seizure—rotatory nystagmus—always occurred during the paroxysm. Large doses of bromide of potassium, given thrice daily, after administration for a fortnight, produced a most beneficial effect on the character and the number of the fits. After taking the bromide for twelve months he reported himself as cured. This was not really so, for after the lapse of three months he again attended as an out-patient, saying that he had been quite free from the attacks till the week previous, since which time he had had three. He again attended for three weeks, and at the end of that period he assured me he was quite well, and I have not seen him since—now six months ago. In this case bromide of potassium, in 20-grain doses given three times a day, was the sole treatment, and the dose was never increased, neither was the drug given in combination with either digitalis or belladonna. Although rotatory nystagmus was most marked during

each paroxysm, the unstable condition was manifestly governed, so to speak, by the exhibition of the drug, and at last cured.

Another case of epilepsy associated with nystagmus equally interesting is worth recording. During the year 1873, I admitted as an in-patient a delicate, strumous-looking boy, who complained of failing sight. He had horizontal nystagmus, and the ophthalmoscope disclosed hyperæmia of the discs with venous stasis. His chief symptoms were continuous bilious vomiting, dilated pupils, and occasionally a curious nervous discharge, unlike, in general character, a true epilepsy. Grave doubts were entertained with regard to his recovery, acute tubercular meningitis, or tumour of base, being suspected. Under rigid treatment he recovered, and at the expiration of three months, vision, which during the attack had materially suffered, returned. I have now to relate the most interesting point of the case. On the 10th day of April of the present year this patient, now an adult, consulted me privately for confirmed epilepsy, giving the following details:—

After leaving the Hospital in 1873, he remained apparently quite well until the spring of '78, when, from no apparent cause, he began to decline in health, lose flesh, and become nervous. This was followed by cerebral neuralgia of an intensified form, which was in turn superseded by epilepsia gravior. The paroxysms are described as very severe, occurring at intervals five times daily. When under treatment for the earlier illness as a boy, the nystagmus was but slight; now it is most marked. The length of time which elapsed between the first and second illness, the unstable condition of grey matter lying dormant for so long a period, in readiness to again depart from its normal (healthy) functions from a cause difficult in this instance to define, renders the case one of more than ordinary interest.

In the form of minor epilepsy which characterised the early seizures of this boy, may we not infer that, though the cells were not in an actually diseased state, it was but a condition —a departure from healthy life—which portended ulterior disease? Then again, as in this example, how many cases of petit mal pass into the graver form without eliciting but a passing notice? I believe many more than we suspect.

It has never been my lot to diagnose the earliest changes in grey matter which ultimately lead to epilepsia gravior; but I suspect that were it possible to recognise such change—that is, so soon as the cells gave the slightest evidence of abnormal function—urgent and well-directed treatment might be of such service as to end in the permanent health of the unstable matter. This is more or less evidenced by the case I relate of continuous bilious vomiting, with nervous discharges, which, although apparently cured, remained latent for years, ultimately to break out afresh and merge into the graver form of epilepsy. Here, although the nervous discharges were frequent in the earlier illness, yet it is probable that the unstable condition of the grey matter was not advanced, and therefore the attacks were mild. Is it not possible, if the disease during these early stages remains unchecked, that the number of cells having a perverted function seriously increase until a large area of grey matter becomes involved?

Whilst jotting down notes for this paper, I was fortunate to meet with a case in which I truly believe the earliest symptoms of this form of disease were diagnosed. Three weeks ago I was asked by a medical friend to see with him a lady who was suffering from the following symptoms. Sudden sensations as of a weight being placed at the commencement of the spine immediately beneath the occiput. This feeling of weight lasted for a few seconds, and was succeeded by a violent throbbing, "trembling of the blood," she called it; then came flashes of light, rotary nystagmus, and a sudden falling forwards of the body, the fall being saved by seizing some article of furniture. Although entire unconsciousness never took place, yet so soon as the body fell forwards, there was an irresistible feeling to lie flat on the back. After remaining in the horizontal posture for ten or fifteen minutes the paroxysm passed away, to recur again in a few hours. The history was as follows. Very healthy and strong till a year ago, she then passed through a severe scarlet fever. Ever since convalescence from that disease these nervous discharges had shown themselves, and latterly with increasing severity. There had been on several occasions hæmorrhage

from the bowel; but as the system never suffered from it, and the general habit of the body was inclined to corpulency and the face somewhat flushed, I did not consider it a factor in the production of these nervous discharges, much to my medical friend's astonishment, who came armed to the consultation with that idea. He said he had carefully watched the case from the beginning, and it was a nervous system deprived of proper nourishment from that cause. I found the treatment had been chiefly iron and ammonia, which, taken in large doses, appeared to aggravate the symptoms most unpleasantly. Thirty grains of bromide of potassium, with 30-drop doses of tincture of digitalis, taken early before rising and late before retiring for the night, had a magical effect, the third dose subduing all the worst symptoms, and its continuance—thus far—keeping the patient in perfect health. This, I take it, was a case of the first degree. Here, I think, undoubtedly we had the earliest departure from healthy nervous action, the merest instability of nerve-cells which, left without appropriate treatment, would have passed on to grave functional disturbance and so on to epilepsy.

I have mentioned a case of disseminate sclerosis with nystagmus, and as disseminated sclerosis is, as a rule, followed at a late date by nystagmus, I must relate the history of a case now under my care.

Five or six years ago a gentleman of very active business habits suffered a serious loss which produced unusual mental grief, so much so that business was entirely neglected, and his family, as it were, deserted. His wife, who has great faculty for detail, assured me that for the whole of their previous married life he had shown unimpaired nervous energy, and was known to his friends and acquaintances as a man of more than ordinary stamina. Eighteen months after his business loss, his wife noticed that there was a slight dragging of the lower extremities and a decided uncertainty of gait. This symptom gained ground but slowly, and is not now very serious. The upper extremities were next affected. This paresis of the limbs remained for a long time as the only sign of disease going on in the spinal cord, and as it made but slow progress, his family were in hopes that he might recover.

This was not to be. Thirteen months after the first symptoms of paralysis, his wife noticed that he had a laboured manner of enunciation which slowly grew worse. She expressed it as "taking great pains to utter each word distinctly." Diplopia —transient at first, afterwards of a more permanent character —brought him under my care. Nystagmus was not then present, nor did it occur until some time afterwards. The nystagmus, transient and feeble at first, is now persistent and marked. In this case there is considerable interference with the retinal circulation, the discs being white with diminished calibre of arteries, and considerable dilatation of veins. Concerning the ophthalmoscopic appearances in nystagmus, I shall say more hereafter. The very gradual invasion of the nervous centres in this case renders it probable that a lengthened period will elapse ere a fatal termination arrives.

An interesting fact remains to be noticed concerning the apparent atrophy of the optic discs. To all apparent observation, it would seem as if from invasion of the optic tracts or chiasma, total destruction of nerves had resulted, and so total abolition of function. As a rule, this is not the case, arising from the fact that only a portion of the nerve suffers from a sclerosed patch. In other cases, the whole nerve apparently suffers, but not microscopically so, the medullary sheath having alone suffered, leaving the axis-cylinder intact.

To the fact that atrophy (apparent) of the optic disc is not correlated with total abolition of function in all cases, I have, in years gone by, drawn attention. *Vide* papers by me in the 'Lancet,' 'Ophthalmic H. Reports,' and 'Dublin Quarterly Journal of Medical Science.'

At that time pathological investigation had not thrown sufficient light on the subject for me to state, without fear of contradiction, why one apparently atrophied disc should be associated with complete visual loss; whilst another, differing in no wise, so far as the ophthalmoscopic appearances went, should suffer but slightly, and vision be sufficient for ordinary purposes.

That disseminated sclerosis in a large number of cases is followed by nystagmus is beyond doubt, as evidenced by

the writings of Charcot, Moxon, and others.[1] I have seen, I believe, but four such cases. These cases but rarely come within the range of ordinary ophthalmic practice; and as the nystagmus is a symptom which manifests itself during the late stages of the disease, we miss seeing a number of interesting cases which would afford valuable clinical instruction.

The inability to regulate visual co-ordination arises from many causes, but from none more so than direct injury to the medulla oblongata. Many years ago a gentleman, to all appearance enjoying robust health, whilst performing one of nature's functions, horrified the female who suffered his embraces by suddenly rolling on his side speechless. In less than half an hour from the seizure I was with him. The prominent symptoms were stertorous breathing and horizontal nystagmus, with widely-dilated pupils and distended palpebral orifices. In this case there had been sudden bleeding from a large vessel, and considerable destruction of tissue in the medulla. Unfortunately, the injured part was not obtained for further examination, so that the more exact lesion could not be determined.

A similar case to the above occurred some years ago, and from a similar cause. This brain was preserved, and is now, I believe, in our Medical School. The injury in this case was also destruction of tissue in the medulla from hæmorrhage.

Another case of a similar character, but if possible more interesting, occurred in the case of a lady now resident in this town. During, as she believed, perfect health, she suddenly fell down comatose whilst performing some household duty. When first seen by me her symptoms resembled in every particular those of the case first related, with the exception that the nystagmus was transient, occurring at intervals of five and ten minutes, and lasting for varying periods of from ten to forty seconds, the horizontal movements of the eyes being violent in manner from the way in which the muscles acted. In consultation with one of my hospital colleagues, it was decided to bleed freely. This was done to, say the extent of sixteen ounces, with a benefit very extraordinary; for while

[1] Consult an interesting paper by Dr. Moxon, 'Guy's Hospital Reports,' 3rd Series. vol. xx. 'Insular Sclerosis of the Brain and Spinal Cord.'

yet the blood flowed, the coma passed away, the nystagmus ceased, and immediate danger was averted. Although there was a slight relapse, the symptoms recurred in a minor degree, the patient recovered, and perfect convalescence resulted.

A case of injury to the medulla oblongata, followed by nystagmus, is ably reported in the 'Medico-Chirurgical Transactions,' vol. xlvi., 1863, by Dr. Waters. A young man received a severe blow on the left side of the face, followed by dilated pupils and nystagmus. The following day he walked to the hospital. Although he presented no very urgent symptoms, he suddenly expired the day following. A blood-clot occupied one portion of the medulla, and the right restiform body was lacerated. The grey matter of the floor of the fourth ventricle was also involved. This case illustrates how serious a lesion of the nervous centres may be without causing prominent objective symptoms.

I must mention a certain form of nervous disorder which I have had occasion to treat on six separate occasions, two of the cases showing marked diplopia and nystagmus.

The first case which I saw occurred ten years ago, and the patient, an engineer, is still under my care. The symptoms, although approaching in character those which we frequently meet with in minor epilepsy, are, when analysed, different in degree. Until lately I have been puzzled to name this disease, and have been content to term it "cerebral pulsation." The six cases I have seen occurred in men. The first was a civil engineer, the second a timber merchant, the third a man constantly engaged in literature, the fourth a general merchant, the fifth a clergyman, and the sixth a medical man in a large general practice. I mention the occupation of these men to show that the employment of each was one requiring brain work, and that of considerable strain in each case. I am not now referring to that form of passive cerebral congestion which is almost daily met with in over-worked business men, easily cured by rest and quiet and change of scene; but a condition, the nature of which in many particulars resembles the minor epilepsy, although totally different in others.

Notes of the first case seen furnish me with the following particulars:—Mr. C., aged 37, engaged as the principal

draughtsman in the office of a firm of civil engineers, in consequence of a large foreign order, had been drawing plans for many hours each day for several months. The success of the contract depended upon his skill, and as his father was one of the partners in the firm he represented, it made him doubly anxious to succeed. Naturally of a nervous temperament, the strain was too much, and one day, when passing from the office to the workroom, he was seized with sudden giddiness, and for a moment unconsciousness. Neglecting such a warning, he still pursued his usual avocations, until a paroxysm more serious demanded medical aid. On visiting the patient I found a small man with a well-knit frame, and what was quite unusual to his ordinary appearance as of six months previous, a face swollen and flushed.

He gave the following history :—"For months I have had a growing fulness about the brain, as if the blood-vessels were too small for their contents, and that the blood was endeavouring to find an outlet and the vessels were determined not to accommodate themselves to this new state of things." He had frequent hallucinations and impaired memory, the latter ailment being a great source of trouble, as he was frequently forgetting where he had deposited certain papers of importance, and otherwise doing unbusiness-like acts. It is hardly necessary to mention that with such cerebral plethora he had constant headache. Another peculiar symptom which alarmed him was that he suddenly fell forward when walking (this generally occurred soon after leaving an omnibus or railway carriage in which he had been journeying), but always managed to save the fall, by seizing hold of some adjacent object.

On many occasions these seizures were associated with unconsciousness, and always with horizontal nystagmus. The inability to regulate his visual co-ordination would often last for many seconds after consciousness returned, and was a perpetual source of annoyance to him, chiefly from the fact that many of those who had witnessed the paroxysm assured him that it must have been a real fit, "for your eyes rolled from side to side." Other than a disinclination for food, and a somewhat impaired digestion, I could not detect any disturbance of organs. The heart was apparently healthy, but

the arteries were hard and tortuous, having evidently undergone change which materially affected the circulation generally, as evidenced by the sudden fits of unconsciousness, due no doubt to cerebral hæmorrhage.

One peculiarity in the case was that he suffered from traumatic stricture of the urethra—not a bad one, but sufficient to annoy him, and require the passing of a metallic bougie monthly. He had an idea that the cerebral congestion was worse immediately before the time expired for the passing of the bougie. The further history of the case proved that this was not so. One curious phenomenon was a nervous discharge through the retinas of a series of bright flashes, as he described "just as if a number of matches had been struck one after the other within the eyes." Examined with the ophthalmoscope, the optic discs were markedly hyperæmic, the veins enormously distended and tortuous, and a condition of arteries seldom seen, they being hardly discernible from the veins, as if they were carrying venous blood, and also being of a calibre so large as to almost deceive you into the belief that they were actually veins much distended.

The habits of the patient were strictly sober in all things, and he had never contracted syphilis. As medicine and rest proved of little avail, I desired the advice of my friend Dr. Crichton-Browne, then of the West Riding Asylum, who agreed with me that the disease, although resembling the less serious form of epilepsy, was not really that disease. As the treatment adopted after consultation did not prove curative, I at last persuaded him to journey through the United States and Canada. The effect of the sea voyage was very remarkable, and he returned all but convalescent. By strict care and frequent rest the attacks did not recur more than once in six months. He has just passed through a rather severe one which confined him to the house and bed for four days. I have but little doubt the paroxysms would resume their old frequency and virulence should he again return to constant employment.

The other case in which nystagmus was present occurred in a general merchant whose habits were vicious, and whose constitution had undergone much wear and tear. This case

differed from the last in an important point. The hallucinations of the first patient were harmless. In this patient's case they assumed a dangerous form. Watching and restraint alone prevented him doing bodily mischief to his wife, who for the time the cerebral congestion remained was an object of extreme hatred.

Another cause other than excessive mental strain is a dyspeptic condition of a low type. The ill-nourished nervous matter from impurity of blood is probably an early factor in the production of the disease. I feel convinced from the lengthened character this disease generally assumes, and its not being very amenable to treatment, that it may become an entity—a disease which from its symptoms and duration will find a place amongst the ordinary nervous derangements of authors. An analogous form of the disease has been described as cerebral hyperæmia by Dr. Milner Fothergill in the West Riding Asylum Reports, by Dr. Hamilton of New York ('Nervous Diseases, their Description and Treatment,' 1878), and lately by Dr. William Hammond of New York. A condition of the retina is noticed by the last writer upon which I have always laid great stress in these and somewhat similar cases. There is a condition of passive congestion more or less always present, and a peculiar arterial fulness—such as I have just described—which is rarely observed in ordinary cases. Another abnormal condition of the retinal circulation is the extreme tortuosity of the vessels, an appearance which would lead one to infer a diseased condition of the arteries of the brain.

I must now pass on to describe a form of nystagmus with which I have long been familiar, and which I have described elsewhere. This form of the disease I have designated "Miners' nystagmus," from the fact that it occurs in men following the occupation of colliers. In giving a general description of this form of the disease, I cannot do better than extract from my former paper on the subject a few preliminary remarks:

On a Peculiar Form of Nystagmus.

"The history and symptoms differ but little in the cases already observed, but a fact worthy of special note is, that all the

patients as yet examined are by occupation colliers. The disease is ushered in by no premonitory symptoms, is persistent, not amenable to treatment, and usually occurs after the age of twenty-one. Further than the oscillation of the globes, which is usually a horizontal one, no trace of disease—either local or constitutional—can be found. The eyes are normal in shape and colour, the pupils act well, and the muscular movements are performed naturally, when the body is in the erect posture. One peculiar feature of the disease is the influence which the position of the body has over it. In the stooping posture—the position of a miner when at work—the oscillation of the globes occurs; as soon as the body is erect, the eyes cease their unnatural movements. Family history does not point to the inheritance of cerebral disease. Syphilis is not a factor in any one of the cases. The urine is healthy, the eyes present no ophthalmoscopic appearances of disease, and the power of vision is perfect. In some patients the globes oscillate as soon as evening advances, but this is an unfrequent symptom. I was at first impressed with the idea that pigmentation of the retina lay at the root of the mischief, but no single case under my care has presented any disease of that structure. The following is the history of one case. The patient describes the commencement of the very first attack he ever had thus: 'I was stooping at work, being quite well in health, and my eyesight good, when suddenly the light from my lamp appeared to be moving to and fro, and objects became indistinct. When I stood up, the sight returned. This peculiar condition has always since occurred, when I have stooped to begin work; and my eyes have rolled from side to side so long as I have continued with my body bent. As soon as I stood erect, the rapid movements of the eyes ceased, and clearness of sight returned.'

"This man I purposely admitted as an in-patient to watch his case, and try various kinds of treatment. Iron, strychnine, arsenic, quinine, and other drugs were taken without the slightest benefit. He was therefore made an out-patient at the end of six weeks."[1]

For several years after the publication of this paper I had

[1] 'British Medical Journal.' Jan. 3, 1874.

seen but few of these cases. I am indebted to the kindness of our present House Physician, Dr. Barrs, for having lately transferred to my care several cases of this disease.

During my early investigations into the nature and cause of this singular and interesting disease, I was much struck with the fact that each case appeared to be the exact counterpart of its fellow, that the disease occurred without apparent cause, and the pathological bearings were difficult of diagnosis. The last series of cases under my care have thrown considerable light upon the whole nature of the disease, and I therefore feel constrained to relate somewhat minutely its clinical history. In my earlier batch of cases the ophthalmoscope, to my intense astonishment and regret, aided me not at all. This I now ascribe to the fact that the cases then seen by me were of early date, the patients having applied for medical aid so soon as the disease appeared and before structural change (intra-cranial) had become sufficiently complete to affect the retinal circulation or affect in any way the nutrition of the optic tracts. Another and more potent reason of failure to detect pathological change was the short time the patients remained under observation; expecting, as they did, immediate relief and not receiving it, determined them to seek and if possible obtain it elsewhere, and so I was deprived of the opportunity of further clinical observation.

In three out of the number of miners now and lately under my care, the disease has been of some standing, and therefore I have been able to arrive at a more correct conclusion as to its etiology and pathology.

I will relate the history of one case now under my care, which is more or less typical of the rest.

March 11, 1880.—W. W., æt. 44, states that three years ago his visual co-ordination was affected in the following manner. He was stooping with his head bent towards the right side, getting coal, when suddenly the light of his lamp appeared to be moving rapidly to and fro. Much alarmed, he at once assumed the erect posture, when, on again looking at the lamp, the light was stationary. The account of the commencement of the disease is the same in each case I have yet met with. The nystagmus is sudden, never preceded by

symptoms of ill-health, and afterwards is persistent when the miner is at work, but in many cases, indeed in most, the patient has power when in the erect posture to regulate and control the muscular action of the eyeballs. On questioning, I elicited further facts, which were that the day following the first attack of nystagmus, as he was preparing for work, he was attacked by a curious sensation which he said arose at the pit of his stomach and passed upward through his chest and neck towards his head (epileptic aura). He then lost consciousness for a few seconds, and when reason returned, he was surprised to find he had unlaced one of his boots which he had immediately before fastened preparatory to leaving home for the pit. Since this attack the fits have recurred at intervals with nearly always the same result, viz. the removal of some article of dress, either his coat, waistcoat, or necktie. The nystagmus is constant when at work, but in this case the movements of the globes (horizontal) are performed but a few times in each minute, and consequently he can follow his occupation with moderate success. This is the only case I have met with where the patient can continue his employment after once the nystagmus has become persistent. In this case, as in one other, if the patient is cognisant of the approaching fit he can, by quickly swallowing his saliva, prevent it, and he can also ward it off by taking a deep inspiration. In the history of this case, as in that of each one I have hitherto gone into, there is not a single factor which we so frequently meet with in cases of a somewhat similar kind, as a cause, such as syphilis, tumour of brain, meningitis, tubercle, cerebral lesion from injury, typhoid fever, &c. The history in one and all is remarkable for the absence of inherited troubles, and the sufferers have as a rule been strong and vigorous prior to the attack.

I have during the past six months seen six well-marked cases of miners' nystagmus of long standing, and in each patient the instability of the muscular apparatus is associated with a low form of epilepsy (petit mal). In the less-marked case the nervous discharges are so slight that without careful study they might be overlooked.

These seizures, however slight, do undoubtedly form one

group of minor epilepsy which is very frequently clinically neglected and very frequently misunderstood, the treatment being directed to the digestive tract solely; the supposition being that the brain is simply at fault, because it is supplied with blood of a kind insufficient for its proper (healthy) nutrition. This is not so; the two diseases are totally dissimilar. The brain of the confirmed dyspeptic is never benefited by the exhibition of a drug likely to increase the stability of the nervous centres, such as bromide of potassium or Indian hemp; but, on the other hand, is much benefited by drugs which put the general digestive tract into good working order.

The real cause of the disease is difficult of explanation. The men aver it is due to the fact that they are frequently working up to their waists in water for long periods, and that the difference in the workings has a material effect upon their constitutions.

Some pits are notorious for the amount of water they contain, and also for the number of men who are habitually ailing. Other pits are characterised as the healthy ones, from the fact that they are practically free from damp, and the men working in them are but seldom ill. I have but little doubt that this statement is truthful, and as wet and cold are the immediate cause of so many serious diseases of the spinal cord, we may, I think, say that the frequent immersion of the lower half of the body in water is the primary cause of the disease.

One fact we must not lose sight of, which is that in miners' nystagmus the oscillation of the eyeballs only occurs when the miner is at work and when the head and neck are much bent. This fact leads us to the belief that the particular area (medulla) is, so long as the neck is thus strongly bent, in a condition of venous engorgement, consequent upon the pressure on the large blood-vessels of the neck; and as the pressure is constant—that is, constant so long as the man remains at work—there is a continuous cell-discharge from unstable grey matter, rendering visual co-ordination impossible. The fact that so soon as the patient assumes the erect posture the nystagmus ceases, renders it clear that venous engorgement is the chief factor in this curious phenomena.

I copy from my note-book the ophthalmoscopic appearances of the fundus in each of the last eight cases of miners' nystagmus:—

Case 1. The discs are red. Marked venous stasis.

Case 2. The disc of the right eye is normal, but the veins carry too much blood; the disc of the left eye is pale, and the venous stasis very marked.

Case 3. Hyperæmia of discs. Vessels rather too full.

Case 4. Discs natural. Veins very tortuous and distended.

Case 5. Discs anæmic. Vessels normal.

Case 6. The appearances are normal in each eye.

Case 7. Hyperæmia of discs; veins singularly tortuous and distended.

Case 8. Discs red. Veins distended. Arteries, in comparison, very small in outline; possibly normal in calibre, but they appear small in close proximity to distended veins.

With but few exceptions, the ophthalmoscope disclosed a venous stasis which is always more or less persistent. In a few cases opposite conditions of the disc are noticed: in some cases we find anæmia, in others hyperæmia, and occasionally the disc appears normal.

Treatment proves but of little avail. I have tried many drugs, and have continued their use for long periods, but have never as yet met with success. The nearest approach to success was in the case of a man who suffered from a very exceptional form of miners' nystagmus (the oscillation being continuous). The liq. strychniæ had a speedy and marked effect in checking the undue movement of the globes whilst he was away from work. On resuming work, as soon as he bent his head and neck the nystagmus returned, and he was compelled to again leave his employment.

ON MUSCULAR SPASMS KNOWN AS "TENDON-REFLEX."

BY AUGUSTUS WALLER, M.B.

MUCH attention has of late been conferred on a certain class of spasm symptoms, viz. tendon-reflex phenomena and cloni. Their clinical import is an independent fact, their physiological interpretation has hardly yet come to rest in a satisfactory generalisation. First demonstrated for the extensor cruris by percussion of the ligamentum patellæ, the demonstration has been extended to most of the prominently acting muscles of the body.

To commence with the best-known instances, let us consider the "knee phenomenon" and the "ankle-clonus." These are spasms elicited—the former by percussion of the ligamentum patellæ—the latter by sudden passive flexion of the foot. The former is seen as a single, the latter as a multiple spasm, and they are commonly found associated in threatened, incipient, or progressing contracture. The first question, therefore, that suggests itself is: wherefore a *single* rectus-spasm and a *multiple* gastrocnemius-spasm?

Assuming that the effect on the muscle is brought about by a pull of its ligament,[1] the answer is obvious. At the knee the single blow is the single stimulus to a muscle which

[1] Tschiriew ('Arch. f. Psych. viii. 3) has shown that, with an uninjured tendon, percussion is the only stimulus that can excite the spasm; that this stimulus remains effective after ligature and crushing of the tendon, and after division of all nerves to the joint; that subsequently a sharp pull of the cut tendon still excites the spasm. Dr. Gowers' observations point to the same conclusion. Further, electrical stimulation of the ligamentum patellæ does not provoke any muscular reaction; and in investigating cases where there is no reaction to tendon percussion, the difference between a blow on the patella or on its ligament can be felt by the hand placed on the rectus. In the latter case, vibration of percussion is far more distinctly perceived.

contracts and then remains quiescent; at the ankle the first contraction excited by the tension of passive flexion restores the mechanical readiness to a second tension stimulus by passive flexion—the reactions of the muscle break a continued flexion into successive jerks, each jerk causing a contraction, each contraction making ready for a jerk. A clonus or series of spasms thus obtains which is not to be classed as a rhythm by continuous influence.

Just as the exaggerated phenomena are commonly associated in disease, so are their normals commonly associated in health. The kick provoked by a blow just above or below the knee and the dancing of the leg are tricks of boyhood, and every one knows how suddenly a man can be pulled down by a blow across his hamstrings. We see in them the same difference of "façon d'agir" as in their clinical congeners—in the one case a single tensile jerk to the tendons of thigh-muscles, in the other a tensile jerk to the tendon of the calf-muscles, repeated at each fall of the limb.

The identity of the mechanism is further established, inasmuch as: 1st. A single tap on the tendo Achillis of the *free* foot causes a single extension of the foot. 2nd. Percussion to the rectus of a *fixed* leg, evokes both in normal and abnormal cases, not always a single spasm only, but sometimes a short series of two, three or more spasms.[1] 3rd. In cases of abnormal exaggeration, a knee-clonus may sometimes be demonstrated, of the same spasm-frequency as the ankle-clonus. In some normal cases the clonic tremor with which we are familiar in muscles crossing the ankle-joint, may be imperfectly imitated in muscles crossing the knee-joint, by placing the leg so that the relation between tendon-extension and weight to be lifted will allow the falling weight to excite the contraction that raises it again.

Muscular contraction, provoked by muscular extension, is

[1] This may be explained as follows: The elastic extensibility of muscle is greatest during contraction. If it contract while both its insertions remain fixed, its actual length is unaltered, while physiologically it is extended by the resistance to its own contraction. Thus it is, that percussion of the ligament of the fixed rectus causes (1) contraction in response to tensile jerk; (2) contraction in response to the momentary passive hyper-extension at cessation of contraction.

the element common to all these phenomena; any blow on tendon, or muscle, or near muscle, that excites the muscular fibre, does so by *extensile vibration*.

Knee-clonus, as a clinical symptom, is frequently to be found in cases where the ankle-clonus is pronounced. It may be produced, sometimes by a flexing jerk of the extended limb, sometimes by percussion of the ligament, or muscle, or patella, and it sometimes supervenes on an attempt to extend the leg, or in continuation of a single excited spasm, when its spasm-frequency is, of course, diminished by the weight of the oscillating limb. It is necessary that there should be a certain balance between muscular contraction and resistance to contraction, in order that the movement initiated by any tensile jerk shall be repeated by sudden restoration of extending resistance. The foot lends itself to the setting of this balance far more aptly than does the leg, and it is more difficult, on a patient, to demonstrate knee-clonus than ankle-clonus, or on oneself, with unenhanced irritability, to set going a knee-clonus than to arrange the foot to dance. Perhaps the easiest method to get a knee-clonus is to tap the patellar tendon of the leg fixed at a certain angle of flexion; a short series of spasms will appear in the rectus, presumably when the conditions allow of reverberation between contraction, and momentary extension on cessation of contraction. By extending the leg for an instant, and allowing it to drop slowly, it may be noticed that as it passes through a certain angle of flexion, breaks in the uniform movement occur; just as in the slight nystagmus of debility, lateral jerks are seen at a certain ocular angle, which disappear with further effort, and reappear on its gradual relaxation. Such tremor, whether it be in leg, or eye, or other part, is a rudimentary instance of the more striking and easily excited clonus, or nystagmus, or epileptiform spasm of morbid irritability. It is possible for a brief period voluntarily to maintain the leg at that angle where extension by weight and weight-sustaining contraction shall be so related as to reverberate. But the conditions to a continuance of such motion are not favourable; the limb tends to fall out of the correspondence between muscular extension and muscular contraction, which is the condition of the rhythm, i.e. there is too

much weight, too little contraction; or it is raised out of the correspondence by an excess of voluntary contraction, i.e. there is too little weight, too much contraction. When, however, the muscle has become fatigued by more prolonged extension, this excess of contraction over weight becomes removed, and the clonic tremor may be seen to supervene in the completely extended leg.

The following table contains the condensed notes of cases hearing on points in question, with time measurements of some of the phenomena.

No.	Case.	Phenomenon.	Time.
I.	*Right Hemiplegia* . . .	Patellar tap to rectus-contraction	R. ·04 L. ·045
II.	*Cerebral Disease.*—Double optic neuritis. Tumor?	Patellar-tap to rectus-contraction	·04
		Front-tap to gastrocnemius-contraction	·045
III.	*Syphilitic Paraplegia* . .	Patellar-tap to rectus-contraction	·035–·04
IV.	*Paraplegia*	Ditto	R. ·05 L. ·05
V.	*Anterior Poliomyelitis.*—Exposure during Zulu war; no contraction in response to percussion at any part other than left wrist; reactions of degeneration.	Wrist-tap to wrist-extension	·0525
VI.	*Normal*	Patellar-tap to rectus contraction	·05
VII.	*Right Hemiplegia* . . .	Ditto	R. ·05 L. ·0475
VIII.	*Double Sciatica*	Ditto	R. ·05 L. ·05
IX.	*Locomotor Ataxy* . . .	Ditto	R. ·055 L. ·055
X.	(?)	Ditto	·0425
		Front-tap to gastrocnemius-contraction	·04
XI.	*Spinal Syphiloma.*—On left side, no reaction to patellar-tap, no knee-clonus, ankle-clonus, reactions to front-tap and Achillis-tap excessive. On right side, reaction to patellar-tap excessive, knee-clonus, slight ankle-clonus.	Patellar-tap to rectus contraction	R. ·05
		Front-tap to gastrocnemius contraction	L. ·05
		Achillis-tap to gastrocnemius-contraction . . .	L. ·05
		Knee-clonus, R. per sec. .	10
		Ankle-clonus, L. per sec. .	10

No.	Case.	Phenomenon.	Time.
XII.	*Disseminated Sclerosis.* — Right hemiplegia 13 years ago. On right side exaggerated patellar reaction, ankle clonus, knee-clonus.		
XIII.	*Left Hemiplegia.* — Right rectus reaction excessive. This was the only exception to the rule, viz. increased excitability on the diseased side. There may have been an error of measurement, or in my notes; or the reaction may have been becoming abolished. The case was lost sight of.	Patellar-tap to rectus-contraction	R. ″45 L. ·6
XIV.	*Normal*	Patellar-tap to rectus-contraction	·036
		Achillis-tap to gastrocnemius contraction . . .	·04
		Galvanic stimulus to rectus	·033
		Galvanic stimulus to gastrocnemius	·033
XV.	*Progressive Muscular Atrophy*	Wrist-tap to biceps contraction	·05
XVI.	*Paraplegia.* — So - called spinal epilepsy. Any sort of impression is liable to induce violent spasmodic agitation. If patient extend his leg, it instantly enters into violent clonus, followed by clonus of the opposite leg, of the abdominal muscles, and of the upper extremities. The violence of the movement is such as to shake the bed and even the room. Cold or anger are particularly liable to excite the agitation. By firmly grasping the rectus, the clonus of that muscle may be arrested. The patient's friends have been accustomed to sit upon him, in order to arrest the general convulsion.	Ankle-clonus, per sec. . .	8
		Knee-clonus, per sec. . .	8

No.	Case.	Phenomenon.	Time.
XVII.	*Left Hemiplegia.* — It is noteworthy that a tap on radius provokes flexion of the forearm; a tap on ulna, extension of the forearm; a tap on knuckles, flexion of the fingers	Wrist-tap to biceps-contraction . . . . . Patellar-tap to rectus-contraction	" ·045 ·05
XVIII.	*Syphilitic Paraplegia.*—No response of rectus to patellar-tap on either side; on right side, foot is everted in response to a tap on the ligament, or on the patella, or on the tibia; at the same time the hamstrings are felt to tighten.		
XIX.	*Right Hemiplegia and Aphasia.*—Late contracture in active state. A tap on any bony point of right arm or on clavicle provokes violent flexion and extension, chiefly of the arm, frequently passing into a rapid true clonus of the whole extremity, lasting about 30 seconds.		
XX.	*Left Syphilitic Hemiplegia.*—All reactions are increased on left side. Excessive reactions of several muscles of upper extremity to tap on wrist. It is noticeable, however, that with tap on radius, or radial side, a flexion of the arm is evoked; with a tap on the ulna, or ulnar side, an extension; tap on knuckles excites flexion of fingers.		
XXI.	*Traumatic Paraplegia* . .	Ankle-clonus, per sec. . . Knee-clonus, per sec. . .	8 to 9 10
XXII.	*Traumatic Paraplegia* (child).	Ankle-clonus, per sec. . . Knee-clonus, per sec. . .	10 9

It obtained throughout the above cases that a greater irritability of muscle to extensile vibration is associated with lesions that isolate spinal segments from superior influences; despite of the usual association with contracture it does not necessarily follow that each reaction is from the emancipated centre, but only that some influence from the centre (viz. the reflex tonicity maintained by the spinal cord) normally furnishes to peripheral elements, muscular or intra-muscular, a *condition* of the reaction. Abnormally under excess or defect of such influence the muscular reaction may be enhanced or fail.

To resume the identification of the phenomena at the knee and ankle-joints, let us consider the round numbers of their time estimates. They are

Achillis-tap to gastrocnemius spasm . . .	·03″ to ·04″
Patellar-tap to rectus spasm	·03″ to ·04″
Ankle-clonus	8 to 10 per sec.
Knee-clonus	8 to 10 per sec.

These numbers plead in favour of the argument that the mechanism of analogous spasms at the two joints is identical. We have seen cause to attribute throughout the same stimulus to both kinds as types of a class, therefore the mechanism of all the above spasms is probably identical.

With regard to the question common to them all, namely: Is the mechanism wholly peripheral or reflected from spinal centres? (1.) Tschiriew finds for the quadriceps of rabbits, that the reaction is abolished after section of anterior roots, or of posterior roots, or of that limited portion of the cord whence the crural nerve proceeds, even if at the time of tendon-percussion, muscular tension be maintained by moderate faradisation of the peripheral nerve stump. (2.) The clinical records of neurologists (Westphal, Erb, Buzzard, Grainger Stewart, Charcot, Gowers, Bramwell, &c.) prove that the abolition of the reaction corresponds with incapacitations of spinal matter (e.g. ataxy, infantile paralysis), that its exaltation is associated with interruptions above grey matter, and is especially a token of irritability, in a centre undergoing the irritation of degeneration (e.g. paraplegia, lateral sclerosis). (3.) As the effect of strychnia, by which the irritability of spinal centres

is enhanced, muscular reactions increase in vigour. (4.) The latent interval between stimulus and contraction is presumably greater than that of a muscular latency. (5.) Contractions identical with those by percussion of tendons, may be provoked by percussion of remote parts, e.g. bony joints, and in some cases crossed contractions are elicited.

By data (1) (2) and (3), no more is proved than that a certain influence from spinal centres is necessary to the reaction of muscles by the percussion of their tendons; (4) is of no value—if a period of ·03″ (*vide* note, page 187) is above the presumable value of direct muscular latency, it is also (as Dr. Gowers has remarked) below that of a reflex event. Helmholtz's original experiments gave for the nerve transmission-rapidity 30 to 90 m. per sec. according to temperature. Bloch has stated that the rate might reach over 150 m. per sec. My own measurements assign to it under ordinary conditions a value between 30 and 50 m. (*vide*

Fig. I.—Nerve Transmission-Rapidity.

Fig. I.). Therefore, roughly speaking, to take rectus and gastrocnemius respectively ½ and 1 m. distant from their

Fig. I.—Electric latency of a thumb-index pinch, recorded on the revolving cylinder by a lever-bearing tympanum, with which was connected an explorer between thumb and index as "pince myographique." Quick rate of cylinder – 3 mm. = $\frac{1}{100}$ sec. – tuning-fork tracing 100 vv. per sec.

s - s'. Physical latency of media.
s' – c. Latency of stimulus to median at bend of elbow.
s' – c'. Latency of stimulus to brachial nerves above clavicle.
c – c'. Difference, expressing time occupied by nerve-impulse between these two points.

N.B.—S to s' is the physical latency of the transmitting media ascertained by

spinal centres, the nerve-delays should be about ·02″ to ·03″ and ·04″ to ·06″, to which have yet to be added the central and muscular delays which make up the total reflex in-

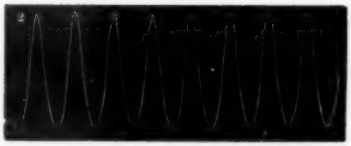

FIG. II.—KNEE-CLONUS.

terval. The gastrocnemius reflex latency ought to be sensibly greater (about ·02″ to ·03″) than the rectus latency,

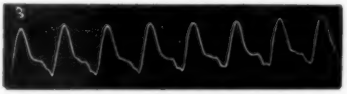

FIG. III.—ANKLE-CLONUS.

whereas I have found it to be about the same (·03″ to ·04″. *Vide* Figs. IV. and V.). And finally I find that the direct latency of the gastrocnemius and rectus to galvanic

independent measurement. Stimulation made by contact of metal-point with knife-edge on revolving cylinder, whereby current is closed and opened. Instant of contact s recorded by a contraction while cylinder is stationary. Intervals between instant of contact and contraction $s - c$, $s - c'$, shown with cylinder at full speed. Taking the intervening length of nerve at 30 to 35 cm., the interval (in this tracing slightly less than $\frac{1}{100}$″) denotes a nerve-transmission rapidity between 40 and 50 metres per sec. In the tracing figured, three successive contractions of each stimulus were allowed to coincide, as a testimony of mechanical accuracy. Tracings, from which estimates were actually taken, were made fine enough to allow of microscopic measurement.

Fig. II.—Knee-clonus (No. xviii.); Fig. III., ankle-clonus (No. xviii.). (Medium rate of cylinder, 5 cm. = 1 sec.)

NOTE.—Tschiriew estimated the percussion-contraction interval at ·033″. Dr. Gowers estimated it at ·10″; for the "front-tap" he found it to be ·04″ to·05″; for the ankle-clonus he found a spasm frequency of 6 to 8 per sec., for a knee-clonus of 2·5 per sec. From this he is led to the belief that at the knee the phenomenon is reflex (there being also a slight indication of a direct contraction), while at the ankle it is direct. Measurements that I made to control the discrepancy led me to assign ·04″ as the mean latency of the knee-phenomenon, while for the knee-clonus I found a spasm-frequency the same as for the ankle-clonus (viz. 8 to 10 per sec.) (*vide* Figs. II. and III.). I therefore concluded that Tschiriew's estimate is the more accurate one. There may have been a trifling excess in some of my first measurements (viz. ·05″), where percussion on a tube across the ligament made the signal, due to a minute delay suffered by the percussion vibration along

stimuli applied to their motor point is longer than has been assumed, viz. about ·02″ (*vide* Fig. VI.). (5.) When percussion provokes contraction it is by transmission of vibrations to

FIG. IV.—TENDON-PERCUSSION LATENCY OF RECTUS.

irritable muscles, their irritability may be so diminished that vibration viâ tendon is insufficient, and percussion directly to their substance is necessary to excite contraction (e.g.

FIG. V.—TENDON-PERCUSSION LATENCY OF GASTROCNEMIUS.

ataxy). On the other hand their irritability may be so increased that the vibration by percussion of the bone into which

tendon to muscle—a medium of imperfect rigidity—or to a trifling advantage in time for the manifestation by the lever of a sharp percussion impulse over that of the more massive contraction impulse. M. Brissaud's recent measurements, with which I was not acquainted at the time, are nearly identical with mine, viz. ·035″ to ·05″.

Fig. IV.—Percussion latency of rectus (normal subject). (In this tracing 12 mm. of the abscissa denote the latency, viz. ·04″.)

P denotes percussion of lig. pat.

c denotes contraction of quadriceps.

Fig. V.—Percussion latency of gastrocnemius (normal subject).

P denotes percussion of tendo Achillis.

c denotes contraction of calf.

Recorded by a lever-bearing tympanum, in connection with an explorer fixed on the muscle. A tube, branching off the tympanum tube and crossing the tendon, was first employed to record percussion. But the jar communi-

they are inserted, or of still more remote parts, is competent to excite their contraction. This was well exemplified in Cases XVII. and XX., where by percussion of radius the fore-arm received a flexing spasm, while that of the ulna provoked an extending spasm. Naturally, along rigid bones vibrations most readily travel. I have frequently observed the same

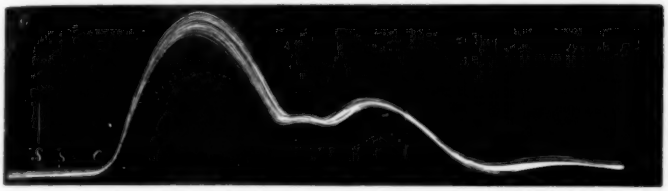

FIG. VI.—ELECTRIC LATENCY OF RECTUS.

to occur in weakly subjects (e.g. phthisis). With regard to "crossed reflex" though I have often seen clonus invade the opposite extremity, I have not witnessed any case where a simple spasm of rectus was undoubtedly crossed; at the most there has been adduction of the limb opposite to the one percussed. In such cases the excessive movement affects the trunk, and gives rise to an appearance of contraction in the opposite limb. Extent of agitation appears to be as naturally referred to extent of vibration in irritable muscles and vigorous contraction, as to spinal diffusion. (6.) The percussion-contraction interval is the same, viz. about ·035", whether the substance or the tendon of the muscle be struck.

cated to the explorer by the percussion is sufficient (as in the above two tracings) to record its instant. It is also more satisfactory, since it eliminates certain sources of fallacy, e. g. time of vibration-transmission along tendon and muscle.

Fig. VI.—Electric latency of rectus (normal subject:) in this tracing the latency is ·02" (quick rate – 3 mm. = $\frac{1}{150}$ sec.).

Stimulation made and marked as in Fig. I. Interval between instants of contact and contraction $s - c$ shown with cylinder at full speed. Fifty successive contractions coincide in this tracing.

$s - s'$ = physical latency of media.
$s' - c$ = neuro-muscular latency.

The ordinary provocatives of neuro-muscular contraction may be ranked as follows, in order of efficacy:

1. The galvanic or continuous current.
2. The faradic, or interrupted current.

3. Direct percussion of muscle.
4. Percussion of the tendon of a muscle.[1]

5. Percussion of the bone into which its tendon is inserted.
6. Percussion of still more remote parts.

If a muscle react to any one of these stimuli it will react to all preceding stimuli on the above list. If a muscle do not react to any one of these stimuli, it will also not react to all succeeding stimuli. The stimulus to which a normal muscle reacts ranges between 3 and 4. Its irritability may be increased so that the muscle reacts to 5, or to 5 and 6; or it may be diminished so that it only reacts to 2 and 1, or to 1, or not at all.[2]

Exceptionally it happens that at certain stages of altering irritability, non-response to one stimulus is associated with excessive response to a preceding stimulus—e. g. in Bell's palsy, as is well known, there is a period when reaction is 0 to faradaism, + to voltaic interruption; in ataxy Dr. Buzzard remarks that while reaction to tendon-percussion is 0, reaction

[1] According to the usual view, direct percussion of muscle provokes direct contraction—percussion of its tendon, reflex contraction. I find the percussion-contraction interval of the former to be ·03″ to ·035″; (i.e. the same as in the so-called reflex), and cannot therefore subscribe to the distinction. At the same time I fully recognise the value of the sign, the importance of which in the diagnosis of tabes Dr. Buzzard has made clear—viz. absence of "tendon-reflex," with muscular response to a direct blow, or to faradaism.

[2] Practical bearings of the above propositions are not far to seek. For instance, if a tap on the ligament or on the substance of any muscle cause it to contract, we know, *ipso facto*, that that muscle will respond to faradaism, and *à fortiori*, to galvanism; so that a fillip to the muscle will frequently spare the application of a superfluous electrical test. If it happen to a litigation patient that one physician should swear to the presence of tendon-reflex, or of mechanical irritability—say in the rectus muscle; while another should vouch for the absence of electric contractility in the same muscle, we know that the two statements are incompatible. The question is reduced to one of probability between affirmation of positive observation, and affirmation of negative. It is less likely that an observer testifying to a contraction seen and felt should be the victim of delusion, than that a witness to the absence of electric contractility should have failed to test or observe completely.

to direct percussion frequently appears to be +. Of these facts I do not attempt any explanation at present.

I am led to doubt the now generally accepted theory that the reactions known as clonus and tendon-reflex are subserved by spinal nervous arcs; while I admit as their highly probable "sine quâ non" the reflex tonicity exerted by the spinal cord. The fact remains constant that spinal conditions, by some influence, be it mediate or immediate, modify the response of muscle to extensile vibration. The foregoing paper contains facts militating against the theory in possession; it does not furnish data of theoretic construction, I have therefore no right to evolve gratuitous supposition. The question has interests broader than those involved in the interpretation of a clinical symptom; its discussion is reserved for a future occasion.

ON RIGHT OR LEFT-SIDED SPASM AT THE ONSET OF EPILEPTIC PAROXYSMS, AND ON CRUDE SENSATION WARNINGS, AND ELABORATE MENTAL STATES.

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In this paper I speak of the epilepsy of nosologists, sometimes called "genuine" epilepsy, or epilepsy proper. In this epilepsy consciousness is either lost first of all or very early in the paroxysm. Loss of consciousness, as the first or nearly the first thing in a paroxysm, is, I presume, a sign that the central discharge begins in some part of the highest cerebral centres. In epileptiform seizures consciousness is lost late, and is not affected at all when the convulsion is very limited in range; in these seizures the discharge begins in some part of the lower cerebral centres (in some part of Hitzig and Ferrier's region). I think it is important to note, not only in epileptiform seizures but in epileptic seizures, on which side the first spasm or other abnormal condition is. Hence we ought to inquire whether the patient be right or left-handed. In many cases of epilepsy proper the spasm is for the most part bilateral, but rarely is it quite equal and contemporaneous on the two sides at its onset. In many cases the head or eyes or both turn to one side at the onset. We ought to try to get to know to which side the first turning is. Unfortunately the accounts given by the patient or his friends are often little trustworthy. Besides, sometimes the head first turns to one side and then to the other; I mean that sometimes turning to each side occurs before spasm spreads to the limbs or trunk, or, at any rate, before it involves either of these

regions in any marked degree. I had recently under care a case of convulsion in which, in one seizure, the head turned to one side at the onset, and in the very next seizure to the other. If we find, however, that the first spasm is always on the same side in every seizure, we may reasonably infer that the "discharging lesion" is of some part of the opposite cerebral hemisphere. In some cases there is no turning to one side; the eyes may go up and the head back. I suppose this is owing to great rapidity of the discharge.

I think the time has come for recognising that many different epilepsies are grouped under the one term epilepsy; we have come to recognise that at least several different epileptiform seizures are grouped under the term epileptiform. The paroxysm of epilepsy which begins by vertigo is a different epilepsy from that beginning by a sensation referred to or near to the epigastrium (solar plexus?). The seats of the "discharging lesion" must differ when there are these two different paroxysms. There are, at any rate, as many different epilepsies as there are different warnings; the so-called warning is simply the first result from, or during, the central discharge; it is the thing of most localising value. Besides, it would appear to be very evident that the "discharging lesion" may be in either the right or in the left cerebral hemisphere. I wish to urge, Firstly; that we should study—not the epilepsy of nosologists, but each different epilepsy as distinguished by its particular warning. I fully believe that it is a good thing to take epilepsy to be a sort of clinical entity, and, for an example, to work up the "warnings of epilepsy." In this way we can say that of sensation "warnings of epilepsy," coloured vision is common, noise in the ear rare, and taste very rare. Such are empirical generalisations of value. Like other physicians I have long worked in this way. But to make rational generalisations we should also work in another way. Instead of speaking only of different warnings "of epilepsy," I think we should say, too, that there are different epilepsies each with its own warning, and some with no warning. Secondly; we should observe each epilepsy throughout, from the warning, if there be one, through the paroxysm, to the after condition of actions, when there are any. To begin with, we

must study groups of cases according to the warnings. This kind of study is extremely difficult. It is to be understood that some of the statements I put forward as results of such study are made with great diffidence as to their exactness. He who undertakes a task of this kind is sure to make mistakes, however careful he may be. This short paper, I may say, represents great labour.

I dare not state it as a fact, but my impression is that when an attack of epilepsy starts by vertigo, *in the sense of there being apparent movement of objects to one side*, the first part of the convulsion is usually right-sided, and that external objects appear to be displaced to the right. Such vertigo would signify discharge of some part of the left cerebral hemisphere. I have put this doubtfully, partly on account of the difficulty there is in getting trustworthy information from the patients and their friends, and partly because some observations made at my request do not support impressions from what I have personally gathered from patients. It may here be remarked that the term "vertigo" is often used somewhat loosely. I do not take the expression "giddiness" from a patient's mouth to always mean true giddiness. We have to put down not his name for, but the description he gives of, the sensation he calls giddiness. Unless we take pains to be accurate in our examinations as to the question propounded, our observations will be of little value. The investigator who simply asks leading questions on this and some other matters to be mentioned shortly is not accumulating "facts," but is "organising confusion." He will make errors enough without adopting a clumsy plan of investigating which renders blundering certain. I would expressly remark that by the expression "epileptic vertigo," a slight fit of epilepsy is not meant, but vertigo in a slight fit of epilepsy, or at the onset of a severe one—that the patient has the sensation of external things moving or of himself turning. I submit that it is inconvenient to use the term "epileptic vertigo" for slight epileptic paroxysms in which there is no vertigo.

Some patients have a "warning" of smell; others, a sensation referred to, or to the neighbourhood of, the epigastrium; others have, sometimes in addition to one of the above-mentioned crude

sensations, movements of mastication, or movements like those of tasting. With these warnings the first spasm, if there be any, is usually on the left side. I suppose the movements mentioned indicate discharge of centres for taste, although the patient has no sensation of taste. It is very rare to find any sensation of taste as a "warning" of any kind of seizure.

I must stay to remark on the movements above-mentioned. It is submitted that they cannot result directly from an epileptic discharge. An epileptic (that is a sudden and an excessive) discharge of the nervous arrangements for these movements would produce that contention of movements which is spasm, not movements properly so-called. I suppose they are indirect (reflex) consequences of discharge of nervous arrangements serving during taste. Mutatis mutandis for rubbing the hands (discharge of tactual centres?), and writhing of arms during suspended respiration, in other seizures. The hypothesis put forward is quite in accord with one of Ferrier's deductions from an experiment, is indeed a re-statement of it with application to disease. Ferrier ('Functions of the Brain,' p. 189) writes: "As regards taste, I think, that the phenomena occasionally observed in monkeys on irritation of the lower part of the middle temporo-sphenoidal convolution, viz. movements of the lips, tongue, and cheek-pouches, may be taken as reflex movements consequent on the excitation of gustatory sensations." In some slight cases of epilepsy the patient spits. I suppose no one would imagine such a highly compound movement to result (directly) from an epileptic discharge. It might, I submit, be plausibly put down as an indirect consequence of discharge of gustatory central nervous arrangements. So then in some slight fits of epilepsy we have not only that "clotted mass" of movements we call spasm, but also movements properly so-called. (I think too that there is in some cases, besides spasm, inhibition of lower motor centres and consequent paralysis.)

There is another way in which the warnings mentioned may be considered, as they are excessive and crude developments of objective or of subjective sensations. Unfortunately the terms "objective" and "subjective," so frequently used by medical men, are used in different senses. Thus, sometimes the term

"subjective" is used for psychical states in contrast to the accompanying nervous states, which latter are then called objective. Sometimes the term "subjective," or the subject, is used for mind, or even without distinction between mind and organism, in contrast to the environment, which latter is then considered objective, or the object. Sometimes the term "subjective" is used for a sensation internally initiated, and the term "objective" for a sensation peripherally initiated; thus, a patient who can smell nothing, and yet has stenches in his nose (at the onset of epileptic seizures, for example), is said to have no objective sense of smell, but to have subjective smell. Sometimes the term "subjective" is used for the patient's abnormal states of mind, pain, for an example, as when it is said "all his symptoms are subjective," in contrast to the symptoms the medical man can himself testify to, spasm, paralysis, cardiac, murmurs, &c. These different contrasted applications of the two terms lead to great confusion in medical writings, and particularly when the same writer uses them sometimes one way and sometimes another. I imagine even that some philosophical writings are difficult to understand, because the term "subjective" is used sometimes for mind and sometimes for organism; and the term "objective" sometimes for nervous states and sometimes for environment (both the organism and the environment are "outside" mind). Hence, without venturing to say how the two terms ought to be used, I may properly say how I use them in this article. I use them both as psychical terms; the term "subjective" answers to what is physically the effect of the environment on the organism; the term "objective" to what is physically the reacting of the organism on the environment. The reader will note that it is not said that subjective stands for what is on the physical side the organism, and objective for what is environment, but that they are used for what are on the physical side the two conditions of the organism in its correspondence with the environment. The correspondence is duplex, and all mental action is a rhythm of subjective and objective states.

Whether vertigo of the kind defined can be shown to occur most often during discharge of the *left* cerebral hemisphere or not, it is, at any rate, a crude development of the most re-

presentative of all objective sensations. Ocular movements represent the most special adjustments of the organism to—of all its reactions upon—the environment. They are the movements especially concerned during orientation. The vertigo mentioned is a crude sensation occurring during strong discharge of the nervous arrangements for these movements, and is dés-orientation, as coloured vision is blindness. In fact, the so-called warning (vertigo) is itself consciousness ceasing in a particular way. What is physically a losing of the most special adjustments of the organism to the environment (désorientation) corresponds to what is psychically (object) consciousness ceasing.

Since most people are right-handed, the left cerebral hemisphere in most people represents the most objective movements, those movements for most specially operating on the environment. Moreover, speech is a process by which are symbolised relations of things in, or as if in, the environment [1] or things considered objectively; nearly all evidence goes to show that the left cerebral hemisphere is in most people the one concerned during speech. I make these remarks on speech in order to ask if temporary aphasia does not more often occur after those epileptic seizures which start by vertigo? I am not speaking of the well-marked and very definite temporary aphasia which is found after some right-sided epileptiform seizures. After some epileptic seizures there is temporary "abnormal talking," and this is sometimes aphasic.

Smell and taste are the two of the five special senses which, even popularly speaking, are the most subjective. Besides the five special senses there are sensations which Bain calls "organic" and Lewes "systemic." The common epigastric sensation preluding epileptic attacks is, I suppose, a crude development of the sensation of hunger—the most representative of systemic sensations. If so, the epigastric warning-sensation is (subject) consciousness ceasing. Hunger is, on the one hand, a desire for food, on the other hand it represents the whole of our tissues as to their state of nutrition. At any rate the epigastric sensation is a systemic and subjective sensation.

[1] Of course one does not use the term "environment" in its narrow dictionary meaning. If a man says his leg is longer than his arm, he is as much making a statement of things objective as when he says this stick is longer than that.

I do not make the statements as to the side first in spasm in relation with "subjective" sensation warnings, for any theoretical reason. On the contrary, they are antagonistic to certain conclusions I have come to from a different kind of evidence. It was a matter of surprise to me to find evidence of left-sided spasm at the onset of convulsions with these "warnings." I used to think the more "subjective" of sensations were chiefly represented in the posterior part of the left cerebral hemisphere. The inference that they occur most often in cases when the first spasm is left-sided is from observations, and I say again, observations, all of which cannot be certainly trusted, the reports of patients and their friends not being always to be relied on.

We have also to note the side first in spasm in cases of "warnings" by crude development of the "objective" sensations, sight and hearing. I think it is usually, but certainly not always, the left. Here, again, we must enquire about right and left-handedness. It is certain that in some *epileptiform* seizures with coloured vision the first or sole spasm is right-sided. Alexander Robertson ('Brit. Med. Journal,' April 18, 1874), narrates a case of right-sided (epileptiform) convulsion with red vision. I have recorded the case ('Med. Times and Gazette,' June 6, 1863), of a woman who had right-side beginning seizures, and at other times "attacks" of coloured vision. A left-handed man under my care in the Hospital for the Epileptic and Paralysed had fits beginning by a noise in the *left* ear. There was in that case tumour of the right cerebral hemisphere within the upper temporo-sphenoidal convolution—Ferrier's auditory centre. Gowers examined the specimen for me, and mentions the case in his second Gulstonian Lecture.

All the crude sensations above mentioned are psychical states, as indeed the term "sensation" implies. It is a grievous error to consider sensations as being active states of sensory nerves or sensory centres; doing so leads to taking such warnings as coloured vision to be of the same order as spasm of ocular muscles, or discharge of centres for them; the coloured vision is of the same order as vertigo. When we say that a patient has numbness and spasm of his hand at the onset of an epileptiform

seizure, we are speaking of things different in two ways: the numbness is a crude sensation, a crude psychical state; the spasm is a physical symptom: the former occurs *during* discharge of sensory, the latter *from* discharge of motor elements of the centre. Confusing sensations with states of sensory nerves or centres leads also to ignoring that sensations occur during energising of motor centres. Nor should we use the term "bodily sensation," unless it is understood to mean a sensation referred to some part of the body. All sensations are in our minds, neither in the body nor in the environment; the correlative physical states are in the body. The peasant supposes redness, sweetness, heat, &c., to be in external objects, although, inconsistently, he does not suppose pain to be in the pin which pricks him. The physical changes during sensations are always in our own bodies. The best classification of sensations is into those which are objective—sensations referred to, or as if standing for, things in the environment—and subjective sensations—sensations referred to the body. But this classification, for obvious reasons, is largely arbitrary. For an example, taste serves chiefly subjectively, if it is a question of the agreeable or disagreeable, how the thing affects me; it serves chiefly objectively when it is a question whether this thing is bitterer than that, when it is chiefly a question of relations of things outside me one to another.

We can now consider certain psychical states during the onset of epileptic seizures which are much more elaborate than crude sensations. Once more there are reasons for noting in cases of epilepsy the side first in spasm, and whether the patient be right or left-handed. I speak first of certain highly elaborate mental states, sometimes called "intellectual auræ." I submit that the term "intellectual aura" is not a good one. The state is often like that occasionally experienced by healthy people as a feeling of "reminiscence," that on which Coleridge, Tennyson, Dickens,[1] and many others have written. It is sometimes called "dreamy feelings," or is described as "dreams mixing up with present thoughts," "double consciousness," "feeling

[1] Quotations are given from these authors by Quærens, a medical man, who reports his own case—epileptic attacks beginning by "reminiscence"—in 'The Practitioner,' May, 1870.

of being somewhere else," "as if I went back to all that occurred in my childhood." Sometimes there is a definite elaborate vision. Very often the patient is sure of some thought, but cannot describe it in the least. Dr. Coats, of Glasgow, has reported such a case. The patient may describe the state vaguely as "silly thoughts." These are all voluminous mental states and yet of different kinds; no doubt they ought to be classified, but for my present purpose they may be considered together.

These "dreamy states" mostly occur with the "subjective" warning — sensations, smell, and epigastric sensation, and with the supposed gustatory movements and sometimes with spitting. They cannot be owing to an epileptic discharge. It would be a remarkably well-directed and distributed epileptic discharge which would give rise to the exceedingly compound mental state of being somewhere else. Besides, it must not be forgotten that there very often is along with the dreamy state one of the crude subjective sensations mentioned. It is scarcely likely that one thing, an epileptic discharge, should be the physical condition for a sudden stench in the nose—a crude sensation—and also the physical condition for an infinitely more elaborate psychical state. I submit that the former occurs during the epileptic discharge, and that the latter is owing to but slightly raised activity of healthy nervous arrangements consequent on "loss of control" —possibly of some in the cerebral hemisphere opposite the one, which I believe to be nearly always the right, in which the discharge begins.

The elaborate mental state alluded to occurs sometimes without any crude sensation warning, but in some at least of these cases the first spasm or one-sided affection is left. In one case, with the dreamy state, the patient's head at the onset of every convulsion turned to the right. I was interested in finding that he was a left-handed man. This was the exception proving the rule. In one case, that of Quærens (see footnote, p. 199), in which the patient had a "reminiscence," the only local symptom was in the right hand, and the patient was not a left-handed person; this case is a clear exception.

In some cases with the "dreamy state" the patient spits. In one case beginning by sensation of smell the patient spat out, and had no dreamy state. I suppose the spitting has similar significance to the chewing, &c., movements.

It is, so far as I know, rare for the dreamy state to attend warnings of coloured vision and noises in the ear. I do not know of a clear case of such association. This is the more remarkable as each of these crude objective sensations is sometimes followed by a less elaborate mental state, "seeing faces" and "hearing voices" (words), respectively. "Seeing faces" is a vastly less elaborate state than the dreamy feelings spoken of, such an one as "being somewhere else," although much more elaborate than crude sensations. Coloured vision and "seeing faces" are not likely to be both owing to an epileptic discharge. Both are psychical states, but the latter is far more elaborate.

I have notes of but one case in which the dreamy state occurred with the objective warning of definite vertigo.[1] In but one of all his fits had this patient any sort of warning. The dreamy state attending vertigo in that fit was a feeling of being in some other place, "several places," not any particular place. I use the expression "definite vertigo," for I have known two cases in which with sensation of external objects moving in front of the patients, not to one side, there was the dreamy state; in one (the carpenter's case, *vide infra*) described as "silly thoughts." This patient has the feeling as if objects were coming upon him. I think this sensation, and that of objects appearing to move away, ought to be distinguished from the feeling of objects moving to one side. I have seen a patient in whom, according to his account, a "dreamy" feeling did not occur with his "giddy attacks," but with other attacks beginning by some thoracic or epigastric sensation. So far the case is very striking, and is particularly so as to the occurrence of mouth movements with the seizures in which there was the dreamy state. I admit, however, that there are apparently some discrepancies, to which I shall try

[1] Dr. Joseph Coats has recorded a case, already alluded to ('Brit. Med. Journal,' Nov. 18th, 1876), of an epileptic, each of whose fits, with few exceptions, was preceded by giddiness and a peculiar "thought." "Sometimes the fit only consists of the aura, followed by a peculiar feeling in the abdomen, which passes up to the head and back to the abdomen, when vomiting results."

to give prominence. The patient recorded his own case, which was published with additions, some years ago, by Dr. Weir Mitchell, who kindly advised him to see me. He had attacks of several kinds. Weir Mitchell writes: "The spells of pure giddiness have been frequent of late. They come on suddenly, and there are none of the strange mental conditions which attend the other spells." The giddiness was clearly paroxysmal, and was attended by a feeling of turning to one side. When I saw him, I had no idea of the importance of noting the particular side to which the tendency to turn was, and had paid no particular attention to "dreamy states." The "other spells" began, by what I gathered when I saw the patient, to be an epigastric sensation, but which he, in his printed account, speaks of as "severe oppression across the chest," making it difficult for him to breathe. He states in his account, "I unconsciously move my mouth as if chewing, and sometimes will also grit my teeth." He describes his mental condition as comparable to that of one suddenly awakened out of a sound sleep. "He cannot catch hold of the dream, which seems to be quickly passing from him, and at the same time he cannot yet appreciate the state of unconsciousness into which he has so suddenly awakened." He writes also: "The things around me seem to be moving; and if I am reading, the book will appear to be going from me, when at once I feel as if all must be a dream, though well knowing at the same time it must be reality . . . through it all the fear of some impending catastrophe seems to be hanging over me."

Here we have together epigastric sensation, chewing movements, fear, and dreamy state. But we have to note that there is in these seizures apparent movement of objects; so then it may be taken that this is exceptional. The apparent movement of objects of course implies changes in himself, some ocular movements or discharge of centres for them. It may be said that he had vertigo; yet in what he himself called his giddy fits he had no dreamy state. I did not ascertain whether the movement was of *all* objects from him as it was of the book. When there is apparent alteration of the distance of objects at the onset of epileptic seizures they usually

appear to come nearer or to be larger, but may seem to go further off. It may be mentioned that on awaking from sleep objects appear to be nearer, and as we get fully awake they recede. Such apparent displacements of objects at the onset of epileptic seizures no doubt depend on abnormal states of the accommodative apparatus or their centres (under atropine objects appear smaller or further off; the reverse for calabar bean). This is very different from displacement of objects to one side attended by a feeling of giddiness. Lateral movements of the eyes will have to do with estimation of the figure (superficial extension) of objects, and symbolise tactual movements; accommodation has to do with distance: it symbolises loco-motor movements (of arms as well as loco-motor movements, ordinarily so-called).

I heard of no one-sided affection in the attacks with the dreamy state. It is to be mentioned that he could talk in them. In other attacks, which he calls "paralysing attacks," there was movement of the mouth; but he is then aphasic, and probably the movement is one of spasm. In these attacks his *right* hand becomes fixed across his chest, and he loses "all control over his words." There is no mention of giddiness in these seizures. He adds: "The same feeling of uncertainty usually surrounds me as in the other." If this refers to the dreamy feeling, the case is so far exceptional. He has, however, attacks of severe giddiness without any dreamy sensation.

The day I had written the above I was consulted by a right-handed patient, who had left-hemiplegia since 1875, and afterwards, since 1876, occasional seizures, like those of genuine epilepsy. All his attacks began by the same "dreamy" feeling, as if he were falling down a coal-mine.[1] In this case there was no other premonitory sensation except something referable to the ear. There was not, at the onset, a sensation of smell, nor any epigastric sensation, nor any fear. I positively could not get to know whether or not he had a noise in the ear, or in the head, nor even with certainty that it was a noise at all; for the patient, after describing his sensation as a singing, said it was not a real singing, but rather a "dulness."

[1] He had had nothing to do with coal-mines at any time, and could discover no reason for this particular recurring "dream."

But the interest of the case is that upon a damaged *right* cerebral hemisphere there should ensue seizures beginning with the voluminous mental state mentioned. This patient had slight seizures, and also occasionally severe ones; in the severer ones the spasm preponderated on the left side. I have ('Lancet,' March 11th, 1876) recorded cases in which noise in the ear occurred at the onset of epileptic seizures; in the second case this was followed by hearing "voices," a fact, however, which was not mentioned in that report. I have seen many such cases, but the case of the left hemiplegic patient above referred to is the only one I have seen in which there was a voluminous mental state with a "warning" of noise; if, indeed, there was in that case such warning.

There are other kinds of psychical states in connection with some epileptic paroxysms. It is not uncommon for a patient to have the emotion of terror and to look terrified at the onset of his seizures. When so, there is usually the epigastric sensation with it. It is to be observed that sometimes there is fear without any epigastric sensation,[1] and that sometimes, although very rarely, there is with the epigastric sensation a pleasurable feeling. I never remember hearing a patient mention the antithetical (objective) emotion of anger; but friends of patients sometimes describe a look of indignation. Yet some patients say that at the onset of their seizures they feel they must attack some one, or have a hatred against some person present. As anger is the emotion of combat, this is equivalent to confession of feeling of anger. I do not know anything definite as to crude warning sensation with look of anger, at the onset of epileptic paroxysm. Theoretically, one would expect it to be an objective sensation. I believe that when the emotion of fear occurs at the onset of a paroxysm, with or without the epigastric sensation, the first spasm is on the left. I have, however, one patient whose fits always begin by fear—as if, to use his words, "something had given me a sudden fright"—and whose first spasm is always right-sided. He, however, is a left-handed man (his father is also left-

[1] After some slight paroxysms, beginning either by the epigastric sensation or by fear without it, the patient's bowels are moved: a fact, I submit, of some significance.

handed). This patient has a sensation, not at his epigastrium, but at the middle of his chest. (The case has been referred to, p. 201, as the case of the carpenter.)

It is not uncommon for a patient to have the epigastric sensation, to look frightened, to feel frightened, and to have also the dreamy state. In this regard another thing is to be considered. Some patients act elaborately after their paroxysms. I would ask, "Are the actions after the fit, apparently coloured by fear, actions of escape, when the seizures start by a feeling of fear? Is the same emotion carried out in each stage?"

When there is a dreamy feeling, the "dream" also may influence the post-epileptic actions. In one case actions of "running away" occurred after a fit beginning by sensation of smell, and with a "feeling of being somewhere else." Another patient always used to run away after fits, at the onset of which she had the feeling of "being miles away." (Correspondingly for spectral faces, voices, &c., after coloured vision and noises in the ear?) As with the epigastric sensation and fear there is often also a "dreamy" state, we may have actions in accord with the "dream," and also coloured by fear. I imagine the actions in some cases, wherein there is the dreamy feeling, except, perhaps, that of reminiscence (which is, I presume, nothing other than a revelation of the earlier subconscious part of the normal process of recognition), are more likely to be adjustments to some "ideal" environment; the dream being made up chiefly of long-past experiences; the actions may be very elaborate and yet not purposive-looking as to the present environment.

I would suggest a corresponding series of inquiries as to seizures beginning by objective sensations, and especially by vertigo. "Are the actions after these seizures more seemingly purposive to the patient's present surroundings, and often those of anger?" "Are they the result of an 'unremembered' or vaguely remembered 'dream,' made up chiefly of recent experiences?" The expression "unremembered dream" may seem absurd at first glance; but we must bear in mind that Descartes, Leibnitz, Kant, Jouffroy, and Hamilton believed there to be no dreamless sleep. It may, however, be held that

there is nervous activity without any attendant mental state in deep sleep, that it is really dreamless, and that any "mental modifications" come during waking. Similarly it may be held that when actions after a fit are very purposive-looking there is no "dream," but yet such kind of activity of nervous arrangements as would in imperfect sleep give rise to a dream, made up chiefly of recent experiences.

When actions are always the same in a patient after every fit, it may be that they are in accord with what occurred about the time of his first seizure.

To repeat. I ask, on which side is the first spasm, or other abnormal condition, in cases beginning by crude sensation of smell, by movements of chewing, &c., by the epigastric sensation with or without fear, and in cases where there is fear without any epigastric sensation? I think it is usually the left side. Again I ask, on which side is the first spasm, or other abnormal condition, when there is a "dreamy state" with or without any of the above-mentioned phenomena? I think it is usually the left. We ought to inquire also whether the patient be left or right-handed. Correspondingly for cases in which there is a crude objective sensation as a warning.

I would ask also that the nature of the actions, when they occur after a fit, should be considered (*a*) as being complex or simple; (*b*) as purposive-looking, or seemingly purposeless; (*c*) as unemotional, or as coloured by anger or fear.

I doubt not that there is some order throughout, from the warning to the end of the post-paroxysmal stage. The above imperfect sketch, the best I can do, is the result of much labour, as a contribution towards discovering this order. I am far from asserting that I have done anything of value towards this end, and trust I have fairly acknowledged the difficulties and uncertainties necessary to investigations in which we have to trust so much to our patients.

NOTES ON LEFT-HANDEDNESS.

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My attention was directed to the subject of left-handedness by a series of articles by Mr. Charles Reade. The view advocated by this writer was that naturally the left hand is as readily used as the right, but that inveterate custom has led men to give an arbitrary preference to the right as the hand which uses the sword, while the left is condemned to bear the shield. He attributes the comparative awkwardness with which the left hand is used to the great care which women take in infancy to accustom children to use the right hand in all difficult operations which require only one arm for their use. Certain it is that infants seem at first to use both hands indiscriminately, and the one arm seems to be at first as well developed as the other, though in process of time the right arm gets more muscular than the left. It is, however, difficult to understand how all nations and tribes, without exception, have in all times of which we know anything given the preference to the right hand, unless they have got some natural reason for so doing, independently of arbitrary usage. Anatomists have pointed out a slight lateral curvature of the vertebral column in the dorsal region, the convexity of which is turned towards the right side, and some have attributed the preference given to the right arm to this bend or curve of the right side. It is, however, more likely the effect than the cause of right-handedness, a deviation caused by muscular action, as explained by Bichat. As most persons are disposed to use the right arm in preference to the left, the body is curved to the left when making efforts, as in pulling, for the purpose of giving an

additional advantage to the muscles, and enabling them to act with more power on the points to which they are attached, and the habitual use of this position gives rise to some degree of permanent curvature. In support of this explanation of the fact, Beclard has stated that he found in one or two individuals who were known to have been left-handed, the convexity of the lateral curve directed to the left side.

On making inquiry in the September of last year, which was done at the request of Dr. Crichton-Browne, who was interested in the subject, I found that there were in the Institution 78 children, 49 males and 29 females, who were using their right hands normally. There were 14 boys and 9 girls, 23 in all, who appeared to use indiscriminately either the right or the left hand; while 7 boys and 6 girls, 13 in all, were decidedly left-handed. On going over our pupils this year, it was found that we had 53 males and 31 females who were right-handed; that 11 boys and 7 girls, 18 in all, used either hand indiscriminately; while 9 boys and 7 girls, 16 in all, were decidedly left-handed. Three girls had ceased to be left-handed during the year, that is, they now use the right hand for sewing and working, where formerly they did the left.

Wishing to ascertain how many left-handed there were among ordinary children, I applied to Mr. Paterson, the teacher of the Sessional School in Larbert, who communicated to me the following observations. Amongst 54 children, whose ages ranged from 4 to 7 years, 8 children had come to school left-handed. They were not allowed to use their left hands in writing or ciphering. Great trouble had, in fact, been taken to make them desist from using their left hands. Some of them had to be kept near the teacher at their writing, but in the playground they threw stones and played at bowls with their left hands. It was thought that left-handedness seemed more prevalent with children likely to be neglected in infancy, but this could not hold good of two of the eight. These children, originally left-handed but now trained to write with the right hand, were not less expert than the rest, and two of them were extra good writers. Of 104 older children out of 52 families 6 boys and 5 girls were left-handed; that is to say, they used the left hand at play, but in the school wrote, or were made to

write, with their right hands. In the whole school, out of 70 girls, 11 girls were left-handed; and out of 88 boys, 8 were left-handed. Thus there was a percentage of 15 girls and 9 boys who were left-handed; and, putting both sexes together, 19 out of 158, that is, 12 per cent. In 1878 the proportion of left-handed amongst our idiots was 11 per cent., somewhat less than in the Sessional School; and in 1879 the proportion was of boys left-handed, 12 per cent.; of girls, 15 per cent.; of boys and girls together, 13 per cent. From this it appears that left-handedness is not more frequent with imbeciles than with normal children. But the cases amongst the imbeciles were much more decided in their left-handedness, generally using their left hands for all purposes; and in the Sessional School the children were all classified as left or right-handed; whereas in the Institution there is a class as large as the left-handed who use both hands indiscriminately. I am aware of the objection to having such an intermediate class, but it was felt impossible fairly to state these children as either right or left-handed.

Thus in the Institution at present, 15 per cent. both of the boys and the girls use their right hand or their left hands indiscriminately. So if there are no more imbecile children decidedly left-handed, there is a much smaller percentage of children who are decidedly right-handed; for while of the normal children in the Sessional School 88 per cent. were right-handed, of the imbecile children now in the Larbert Institution only 72 per cent. were decidedly right-handed.

As idiot children are much less tractable than other children, and it is much more difficult to teach them to use their limbs properly, these results would probably be considered by Mr. Reade as confirming his theory; and it is difficult to deny that custom has a certain power in inducing all those who have a weak tendency to prefer their left hand, to make use of their right one instead. Some people who have been left-handed in infancy, and who through persevering education have been made to use their right hand for acquired work still continue to use their left leg preferably to their right; for example, in kicking, or setting off down a slide.

Luys has asserted that the left side of the brain is earlier developed than the right, so that the left hemisphere in the

new-born child is a few grammes heavier than the right; and in the adult the right hemisphere has been found generally to weigh heavier. If this observation of Luys be correct, the superior weight of the left hemisphere at birth might be held to confirm as well as to account for the habitual preference given to the right limbs.[1] Moreover, if the head be carefully examined, it will be found that its contour is rarely symmetrical on both sides. There is generally a greater protuberance on the left side, a little above or behind the ear, than on the right. On the left side we have a greater curve than on the right, the right side being flatter. This would indicate a greater development of the brain on the left side, near the region where physiologists have placed the motor area of the brain.

In order that there should be less chance of error, I took the cranial outlines of the heads of our inmates with a conformateur. The bulging above or behind the ear in the left side was found to prevail. A very common form of the head was a bulge on the left, behind or above the ear, and a bulge on the right side in front, at the angle of the forehead. Thus the greater size of the left posterior region is made up to a certain degree, by bulging on the right anterior angle. Most of those had a bulge, or increased curvature, on the right side, above or behind the ear; but this did not hold good of all cases.

In a few instances of left-handedness there was very little

[1] Since writing this paper I have had an opportunity of examining two cases which may bear on the subject. B. N., 11 years old, epileptic imbecile, left-handed from early infancy, and subject to very frequent fits, which are occasionally on right side only, when he retains consciousness and is able to answer questions. About 8 months before death he had these partial fits, followed by temporary paralysis of right arm, which also implicated the face. Died apparently from exhaustion, following repeated general convulsions. Whole surface of cerebrum deeply injected, bright red, with patches of deeper hue. The left side of encephalon was smaller than the right. This was especially noticeable in the middle lobe, viewed from below, and the middle fossa of skull was smaller. The pons was also smaller on the left side. The right side of encephalon weighed 20¾ oz.; the left side 15½ oz. H. M., paralytic imbecile, had a second shock after coming to institution, aggravating the old paralysis of the right side. Lingered on for a year in great debility, sinking into deep dementia. The cortex of cerebrum was much diseased and wasted, with adherent membranes and accumulation of fluid within the ventricles. The right side of brain weighed 16¼ oz.; the left weighed 15 oz.

difference, in others there was actually a bulging on the left side. Putting aside the cranial outlines of those, the surface of whose heads were bigger on the right side, I found that 7 were decidedly left-handed, 7 belonged to the indiscriminate class, and 10 were right-handed. Of those whose outline seemed larger on the left side, 5 were decidedly left-handed, 8 indiscriminate, and 50 right-handed. One girl, who was very decidedly left-handed, was much bigger on the left side. In one boy, almost a mute, but with so much intelligence that he might be styled an aphasic imbecile, and who was left-handed, the greater size of the left side of the head was very decided. Those who are left-handed generally kick with the left foot, but not always. I have the cranial outline of a man who was left-handed in childhood, but who was trained to work at a trade with his right hand. In his case the bulging in the head is on the *left* side. On taking the cranial outline of a friend, I remarked that he ought, from the contour of his head, to be left-handed. He answered that he could use both hands almost equally well, and, as a proof of it, wrote his name upon the profile card with his left hand. He observed that his father had been left-handed, and I have met with other facts which make me think that it is worth while inquiring whether this peculiarity may not be hereditary.

It is but fair to acknowledge that I am indebted to Mr. Crochley Clapham for the idea of using the conformateur in this line of inquiry. This able anthropologist has stated, as the result of his extensive inquiries,[1] "that the most common form of skull met with was that having its greatest transverse diameter posterior to the median line, and being most protuberant, with reference to the long diameter, on the left side. This condition of left-handedness was present in 81·771 per cent. of the insane; but, as shown in the regional development table, was much more marked in some diseases than in others; and, as bearing upon the question of which is the 'driving side' for convulsions, it may be interesting to notice that left-handedness is not only very common in epilepsy, but is also

[1] See the paper on "The Cranial Outline of the Insane and Criminal," by Crochley Clapham, L.R.C.P., &c., and Henry Clarke, L.R.C.P., &c., in the 'West Riding Asylum Reports,' vol. vi. p. 154.

more pronounced in this disease than in any other form of mental affection." Mr. Clapham also observes that the "numerical superiority of the left-'headed' agrees with observations made by numerous writers on the greater relative weight of the left cerebral hemisphere. That it has an obvious, though by no means exclusive, connection with right-handedness is shown on comparing the criminal tables, where the opposite state of right-headedness was exhibited in a number of left-handed individuals." Some may hold that this one-sided development of the brain is really the consequence not the cause of right-handedness, that just as the right arm becomes stronger and more muscular than the left by constant use, the corresponding portion of the brain also takes an increased development.

The view that the habitual preference of the right arm really arises from a greater or earlier innate power in the left hemisphere, seems strengthened by the well-known facts of aphasia, and the physiological experiments confirming and illustrating them.

It is scarcely needful to recall that on the left side of the brain in the lower part of the third frontal convolution, or in the operculum, is situated what has been called the speech-centre, where motor acts of articulation take their origin. On the destruction of these parts on the left side, the power of imitating words is lost, though the aphasic patient generally understands words. As the utterance of words requires the combined action of both right and left muscles of the vocal apparatus, it is clear we have here a fair case of one-sidedness in the hemispheres, which can only be denied by denying that in *most* cases of aphasia the lesion is on the left side, and that it is often associated with paralysis of the right arm. This left-sidedness, at any rate, is beyond the reach of mothers and teachers.

Dr. Ferrier observes, in his book on the 'Functions of the Brain':[1] "As regards the articulating centres, the rule seems to be that they are educated, and become the organic seat of volitional acquisitions on the same side as the manual centres. Hence, as most people are right-handed, the education of the centres of volitional movements takes place in the left hemi-

[1] Page 278.

sphere. This is borne out in a striking manner by the occurrence of cases of aphasia with left hemiplegia in left-handed people. Several cases of this kind have now been put on record."

An instance is given by Dr. Hughlings-Jackson,[1] who adds:—"It is admitted that these are cases of left hemiplegia with aphasia in persons who are not left-handed." In such cases we must suppose the main articulating centre to have been in the right hemisphere without inducing the motor centre of the left arm to take the lead. This seems to prove that the connection of sequence or concomitance between the education of the centres of articulation and manual execution in the same side of the brain is at least not inseparable. As a rule the left hemisphere seems functionally the most active, though the right side has also its work, and the left hand executes important actions, such as holding the reins on horseback.

Mr. Crochley Clapham has noticed that left-handedness is more marked in men than in women, which "goes to substantiate the 'crossed-action' theory, as most female employments necessitate the pretty even use of the two hands."

Dr. Wilbur, of Syracuse, New York, had a friend who professed to be able to distinguish a left-handed man from a right-handed, by attentively watching him without seeing him make any special use of the arm. He grounded his observations on the premise that the appearance of the face was also different in the left-handed. Certainly, the configuration of the face and the fulness of the facial muscles often vary a little on each side; but, as far as my observations go, I am not prepared to undertake the challenge sustained by Dr. Wilbur's friends.

Trousseau[2] has remarked that the right and left sides are subject to different diseases. Neuralgia is so much commoner on the left side, that for three years during which he kept notes he did not observe a single example of it on the right side of the chest, when real neuralgia was carefully distinguished from pleurodynia, pleuritic stitches, and hepatic colic.

[1] 'Brain,' October, 1879, p. 329.

[2] 'Clinique Médicale,' Paris, 1868, vol. ii. p. 668.

It may be asked, that where left-handedness has shown itself in a decided manner, is it proper that so much trouble should be taken to make the child break it off? By so doing it is evident that the teacher gives the child a great deal of trouble and perplexity. A left-handed child forced to write with his right hand through fear of punishment, is very much in the same condition as a right-handed one who should be forced to hold his pen in his left. There is no proof that people who remain decidedly left-handed all their lives are less skilful with their hands than others. One of the earliest mention of left-handedness is in the book of Judges, where it is recorded that amongst the 26,700 fighting men of the tribe of Benjamin, there were 700 chosen men left-handed; every one could sling stones at a hair-breadth, and not miss.

On the other hand, it may be argued that as those who are originally left-handed generally retain the use of their left hands for a number of offices, by teaching them to use their right hand we are to a certain extent making them ambidextrous. Another consideration seems much less capable of dispute; since custom has clearly so much play in determining what hand shall be used, it is a misfortune when our acquired expertness becomes the exclusive property of one hand. We ought to practise the left hand as well as the right in difficult manœuvres. There is no doubt, for example, that it is of great advantage for a surgeon to be skilful in the use of both hands, and this can be only obtained by practice commenced in early years.

Critical Digests and Notices of Books.

The Brain as an Organ of Mind. By H. Charlton Bastian, M.D., F.R.S., &c. Kegan Paul & Co., London. International Series, 1880.

The taking title of this book at once suggests the question or questions, what is the brain? what is mind? and what is an organ? and if they do not meet with a clear response, it is not from any want of inclination or ability on the part of the author to deal with them in the fullest manner which scientific knowledge will permit. Dialectic skill, the heritage of metaphysicians, is more and more shared by these new rivals, who are more formidable than the older antagonists the pure physicists; rivals whose forcible endeavour is to prove the correlation of all knowledge, and in this domain especially to correlate those ancient foes, metaphysics and physiology. Surely nothing in these days can be more narrow and misleading than for the metaphysicians to exclaim, "Oh, that is physiology, we have nought to do with that," unless it be a like response from the physiologist in his ignorant abuse of the methods of metaphysics. It is no wonder that the elder science, which attained to the perfection of Aristotle and Plato when real knowledge of living organisms was barely commenced, should have stood alone in sulky dignity long after it ought to have welcomed the alliance of the new power. Nor is it inexplicable that physiologists should tend towards exclusiveness in their attempts to answer all the problems of life by their own methods. But now that the sciences are continually being differentiated and multiplied does it become the more needful to appreciate their essential correlation; and in none so much as in the sciences of mind, and that science of living organisms without which mind, so far as we know, cannot exist.

And when we speak of these sciences of mind, which developed into activity long before a nerve-cell or tube had ever been seen or imagined, we mean, not simply the abstract sciences of ethics or metaphysics, or that guess-work of immaterial ontology which it may still amuse some to maintain and some to decry with equal impotence and futility, but of those concrete sciences of poetry and history, and all those *literæ humaniores* which teach us so much of what we know of the motives and actions of man, and without which the knowledge of the whole mass of physical science would be poor indeed. Conceive the great Chinese nation having got the start of all the world by a thousand years in the art and science of physiology, as they did in those of the fictile manufactures! Clearly they might have attained to a knowledge which we can scarcely imagine of the physical processes of sensation, emotion, and memory, while they remained the children they are in the real science of mind and motive. And this is what our physiologists might do, if their labours did not constantly fecundate other knowledge, which again gratefully repays its debts in adding force and breadth to their own powers in their own domains. Dr. Bastian is an excellent example of this modern combination of the dialectician with the physicist, and his book is a good instance of the correlation of metaphysics with physiology—leaning, it is true, to the latter with a heavy bias, but frankly accepting the more abstract science in all except its unintelligible and indeed inconceivable ontology. It is somewhat intriguing to one's curiosity that writers like Bastian and Bain should think it worth their while to continue these arguments against an ontological essence of mind, while the very idea of such a thing remains unpresentable to the mind, and when it seems to be certain that belief in such a thing is belief in a verbal formula, and not in a real idea. Dr. Bastian commences with an interesting chapter on the Uses and Origin of a Nervous System. As might be expected from his well-known views on the beginnings of life, this chapter contains opinions which are not generally accepted. Dr. Bastian assumes that it is "commonly admitted that many of the lowest forms of life cannot positively be assigned either to the vegetable or the animal kingdom," "creatures of circumstance,"

among whom "variability reigns supreme," "appearing now as animals, now as plants," which he designates "ephemeromorphs." Modes of growth, he says, have been observed to occur in them with frequent and rapid changes from vegetable to animal, and from animal to vegetable; and he compares these changes to the well-known metamorphoses of form and nature amongst simpler kinds of matter, as in the changes from the crystalloid to the colloid form of molecular aggregation demonstrated by Graham, and to the interchangeable states of carbon, phosphorus and sulphur. While we take the author's word for the peculiar qualities of his ephemeromorphs, the analogy to the allotropism of inorganic elements seems forced, and the manner in which these considerations lead through the movements of plants to those of animals, and to the differentiation of nerve tissue, is not very obvious or convincing. No doubt it is right to begin at the beginning, and to seize the first link of the chain if we can, but many physicists will think that there are some important links wanting between allotropic sulphur and the Amœbæ—"the simplest types of unquestionable animal life" with "high inherent activity," and with "the power of executing well-marked independent movements, and of feeding upon solid food." Most people will even think that there is an important link wanting between the allotropic chemical and the self-multiplying Confervæ, and another between them and the amœba, with its high *inherent* activities and *independent* movements.

With independent movements and "the selective power which the amœba seems to manifest," we first appear really to touch upon the problem of mind, for we are supposed to be within the confines of science, so that any misgivings as to the mind of the inorganic universe, or even the loves of the plants, must be excluded. But what do the independent movements of the amœba in the selection of food mean? Probably the author will concede that in a certain sense no movements even the most voluntary of the highest known organism are really independent; for whether the will be determined or not, the movements it ordains are determined, and are therefore not independent. But in a milder sense the movements of the amœba may well be supposed to be far less dependent upon

outward circumstance than those of the insectivorous plants, and, indeed, to indicate the high inherent activities here attributed to them. And what can the inherent conditions be in which these inherent activities develope unless it be the first dim glimmering of consciousness, a condition analogous, if not homologous, to our own consciousness? That no one can positively affirm this to be so or not to be so, is as true of the amœba as of the crayfish, of which Huxley rightly says that without being a crayfish, or at least having been a crayfish and remembering, no one can say whether it is conscious or not. But the same may be said of the author himself. One can only draw the "legitimate inference" that he is conscious. One can by no means claim any positive knowledge that he is conscious. This, however, also would appear to be a legitimate inference, that when an organism, however lowly, shows by independent movements in the selection of food that it possesses inherent activities, it is probable that it distinguishes between the being which selects and the food selected; that is to say, between the *me* and the environment, the *ego* and the *non-ego;* and if this be not consciousness, we can form no conception of what it is, or of what rudimentary consciousness itself may be. This inference, which to many may appear forced and unwarranted, the author does not draw, however near the quoted terms he has employed may seem to lead to it. For ourselves we abide by it as a legitimate inference from the continuous chain of organisms in which there appears to be no break in consciousness. And if it be said that in the amœba and other of the very simplest animal organisms there is no separate organ of consciousness, it may be replied that we have no proof that such a separate organ is necessary for the purpose; and for that matter that the amœba may as well be considered a nerve-cell with powers of digestion as a digestive cell with nervous function. Our author's views as to the states of consciousness of the lower animals are much more restricted. He thinks that even the opinion of G. H. Lewes, that all nerve centres are the seats of nervous sensibility, "would only lead to its extension, and soon make it almost impossible to deny a similar attribute to the leaves of the sun-dew and other sensitive plants, or indeed to stop even

here. Endless confusion might thus be produced without commensurate gain." But no one can believe that any plant is really possessed of sensation, although called sensitive; and the motive of immediate profit or loss to science ought never to be considered, for nature gives long credit to drafts upon her resources which may at first seem untrustworthy. When Dr. Bastian states that "the very existence in the lower animals of any conscious states analogous to those which we ourselves experience is a matter only of warranted inference," he is stating the question with philosophical accuracy, which is more than is needful in a discussion as to the amount of scientific probability. Whether or not sensations or impressions, being "associated with certain subjective phases answering to what we call states of consciousness," arise only "at a certain stage in the complication of the nervous actions of the lower organisms," when the "ingoing molecular movements traverse nerve fibres, and thence diffuse themselves among related groups of nerve-cells," as the author thinks, or whether, as we think, there is an uninterrupted downward chain from man to the amœba, in which states of consciousness, gradually receding from the highest mind to the dimmest differentiation between self and not-self, is a question only of more or less legitimate inference and probability. The hypothesis of continuity, however, does seem more in accordance with the ways of nature and the facts of the case than of discontinuity, which seems to require that "the quick succession of changes in a ganglion, implying as it does perpetual experiences of differences and likenesses, constitutes the raw material of consciousness." We must pass by the excellent anatomical chapters on the structure of the nervous systems and the brains of the different classes of animals, to arrive at the important chapter on the Scope of Mind. We may very well omit as superfluous in these pages any notice of the author's well-put objections to the custom of speaking of mind as "an actual independent existence," or even as "a definite self-existing principle." Mind is not this or that, but according to John Stuart Mill, "what consciousness directly reveals, together with what can legitimately be inferred from its revelations, compose by universal admission all that we know of mind, or indeed of any

other thing." And this passage from the great logician seems to supply the author with a satisfactory account of what mind is, subject, as we shall see, to certain extensions which he himself proposes; and he follows up the curious distinction he makes between the direct revelations of consciousness and the inferences we draw from them, with the reflection that it would be an absurdity to rest content with the conclusion, that we must lean implicitly and conclusively upon these direct revelations of consciousness. But the author does not inform us where inferences exist if not in the consciousness, unless he intends to include them among those "mental phenomena" with which he contrasts "any *other* natural phenomena," because "all other phenomena can only be known in terms of mind." We do not know that this application of the term phenomena is quite new, but it certainly is not quite accurate, for how can a subjective state by any possibility be an appearance? "The imaginative embodiment of these subjective states into a non-corporeal or spiritual Ego, is not altogether (more) surprising." But our author here again permits himself to contemplate, and indeed to be a little scared by the supposed consequences of the truth he is seeking. "If we were to lean implicitly and exclusively upon these direct revelations of consciousness, we must, as the history of philosophy has shown, inevitably commit ourselves to a system of universal scepticism, needing, as Hume proclaimed, a rejection of all grounds of certainty for our belief in an external world, in body, and, indeed, in mind, as an entity—leaving to each one of us a mere fleeting series of conscious states as representatives of the totality of existence. The absurdity of resting content with such a conclusion has been commonly recognized both by philosophers and mankind in general. In fact we use our consciousness to enable us, in imagination at least, to transcend these direct revelations of consciousness. They are by each one of us invariably supplemented and modified, where necessary, by what we deem to be legitimate inferences. Our actual present knowledge is made up of a closely interwoven, potential, but intelligible fabric derived from actually existent, from remembered, described, or inferred conscious states or relations between them, together with inextricably intermixed, and

more or less legitimate inferences therefrom." Thus we have "inferred Conscious States" and "legitimate inferences therefrom" which are not Conscious States, in order that we may not be too sceptical, and reject grounds of certainty, and we so, in imagination at least, transcend the revelations of Consciousness. Surely also "endless confusion may thus be produced without commensurate gain;" and surely in our search for knowledge as to the nature of mind, the bogie of scepticism regarding the existence of body need not scare us, as it certainly will not prevent us from eating our dinner.

But we shall never get to the end of our task if we notice all the author's opinions, which are suggestive, and which seem to call for examination if not criticism, that we may see in what sense or to what extent we may accept them; for this work is far removed from the trite methods of those imitative minds which conceal a rickety knowledge of physiology with a poor veneer of mental science. No doubt it is very difficult to amalgamate physiology and psychology, or to bring into unison what our author calls the subjective phenomena and the objective phenomena of thought, and the difficulty is increased by the fact that the popular if not also the scientific terminology of the matters in question is mostly inherited from times antecedent to scientific inquiry. And this leads us to remark that however we may be inclined to concede that "the notion that Brain is the exclusive organ of Mind can no longer be entertained," and however we may sympathize with the author in feeling the difficulty which arises from excluding unconscious states leading to or linked with conscious states from the term Mind, still we cannot think that "this is no question of choice, but one of absolute necessity. The meaning of the word Mind must be very considerably enlarged, so as to enable us to comprise under its new and more ample signification the results of all the nerve actions, other than those of outgoing currents." On the contrary we think that something else may be done, and certainly must be done, in the gradual formation of a new terminology more consistent with the development of neurological science; and perchance in this manner, even the present generation may escape from being called upon "to bear the discomfort and inconvenience arising from an altered meaning of

the term Mind"—a duty of sufferance which the present generation would probably repudiate. In this manner those who do wish to think and to communicate their thoughts accurately would gradually provide themselves with a verbal armament as suitable to their purpose as their knowledge would enable them to fabricate. And who knows what changes in scientific terms may be found needful, while leaving the old landmarks of language where they are? Nerve centres, discharges, currents, reflections, inhibitions, &c., are they not all terms based upon hypotheses more or less probable but as yet unproved—all of them terms which new knowledge of neuration may at any time relegate to the limbo where *phlogiston*, *humidum radicale*, and other old verbal implements which rust in disuse and neglect?

The lucid chapter on Sensation, Idealism, and Perception concludes with a pregnant paragraph on "the possibilities of intellectual affection and action bequeathed to an organism in the already elaborated nervous system which it inherits. Within this nervous system lie latent the creature's forms of Intuition or forms of Thought, which need only the coming of appropriate stimuli to raise them into harmonious action. It is the fact of the previous orderly organization of the structural correlatives of mental processes, which causes some degree of those modes of mental affection, known to us as Feeling, Intellectual Action, Emotion, and Volition, to be engendered even in the young untaught organism, in response to suitable stimuli."

This explanation of what may be called the mental Instincts, the cause of untrained and untaught cerebral action in the young, is surely also the largest part of the answer to the question of those neurations in adult lower animals which are more commonly known as Instincts. This, indeed, is admitted in the conclusion of the interesting chapter on Instinct, its Nature and Origin, in which the author says: "There can be no doubt that if our means of knowledge were greater than it is, we should be able to explain these and all other Instincts by reference to the doctrines of inherited acquisition, and natural selection, either singly or in combination." It seems to us, however, somewhat unnecessary to eliminate these two doctrines out of one process; for survival of the fittest can

only become influential through long-continued inheritance. We must pass by the excellent chapters on the Brains of the Quadrumana, the Mental Powers of the Higher Brutes, the Configuration, Structure, Function, Relations, &c., of the Human Brain, that we may glance at the chapter From Brute to Human Intelligence. In this linking chapter the author very fairly traces the influence of the possession of articulate speech, "an endowment which, when once started, —whether by some hidden and unknown process of natural development, or as a still more occult God-sent gift to man— was by its very nature almost certain to have led its possessors along an upward path of cerebral development." Is there not somewhat of a circle, or at least an eddy, in the current of this argument? Speech developes the brain; but does not the possession of a large brain develope speech? As the author mentions, the men of the Post-Tertiary Drift lived for untold ages in a state of extreme simplicity. It is doubtful to what extent they were social or solitary; and we have every reason to believe that their language, if they had any, was most rudimentary. Of course, social habits once attained and language acquired, the progress from hieroglyphics to writing and printing and stenography and telegraphy must have run parallel to a progress from simple concepts not unlike the visual images of brutes, through conceptions more and more general and abstract and complicated, up to the highest development of man's intelligence. The well-considered digest of our knowledge on the Functional Relations of the Principal Parts of the Brain has a chapter separated from that which clearly belongs to the subject, namely, Phrenology, Old and New. In considering this latter division of brain-function, the author does well to remind us that "only within the last century has the great bulk of our present knowledge with regard to it [the structure and functions of the brain] gradually taken shape from amidst the clouds of error with which the opinions of the ancients and the mere speculations of the anatomists of later centuries had enshrouded it;" and he gives an excellent résumé of these opinions, culled and condensed, as he says, for the most part from the writings of Prochaska—that neurological mine which has too often been worked without acknowledg-

ment. The old system of Phrenology of Gall and Spurzheim, founded, as the author says, upon a crude psychological analysis, well capped by a very simple mode of hap-hazard and tentative observation, and fallacious in almost every respect, was very different to the new method of experimentation by which questions of the localization of cerebral formation are carefully put to nature. The yea or nay of the general question of localization of function has underlying it the secondary one whether mental faculties are dependent upon separate areas of brain-substance, or whether cells and fibres, so far as position is concerned, are interblended with others having different functions. "Have we to do with topographically separate areas of brain-tissue, or merely with distinct cell and fibre mechanisms, existing in a more or less diffuse and mutually interblended manner?"

The search for perceptive centres, taken up by Ferrier in "a thoroughly systematic manner," and pursued by him "with characteristic energy," led to results which "deserve to be most carefully studied." The reader is referred to the original for full details of these experiments, "made with much skill and judgment;" the author's opinion respecting them being, that "although Ferrier's determinations of the sites which are of most importance for each sense require more confirmation by other workers than they have yet received, before they can finally be accepted as correct, the discrimination and ability with which his experiments have been conducted should ensure for them that careful and thorough testing which their importance deserves." We have only space left to indicate the great interest and importance of the concluding chapters on Speaking, Reading, and Writing, as mental and physiological processes; on the Cerebral Relations of Speech and Thought; and on Problems in regard to Localization of Higher Cerebral Functions; and to take leave for the present of this most valuable addition to the popular series of science treatises, of which it is the youngest recruit, with the expression of our own opinion that the diverse, complicated, and profound problems of psychology and neurology with which it is engaged have never before been so fully, ably, and lucidly presented to the general reader.

JOHN CHARLES BUCKNILL.

Mind in the Lower Animals, in Health and Disease. By W. Lauder Lindsay, M.D. 2 vols. C. Kegan Paul & Co., London, 1879.

This is a work of formidable dimensions, consisting of two volumes of more than 500 pages each, the first being devoted to the mind of the lower animals in health, the second in disease. The author tells us that he had at first intended to produce a book of much less size, but that on attempting it he found the materials so swollen that he could not compress it within its present limits, though we confess to the opinion that some diminution of its contents would enhance the value of the whole.

In substance it is composed of a vast quantity of notes, slowly accumulated by the author, gleaned from a wide area of experience covered by travel and reading, while prompted by the motives of a "physician-naturalist," as he styles himself, in the former capacity being specially occupied with mental disease; but neither does there appear to have been enough partiality in the collection, nor has the matter received sufficient elaboration in passing through the author's mind to have exchanged much of its crude note-like form, for the more compact and comely presentment of ingenious theory, although it has been somewhat arranged and adorned with comments.

Dr. Lindsay says (Introd. p. xiv.) he "attempts to *outline* the subject of *Mind in the Lower Animals*, to illustrate their possession of the *higher mental faculties as they occur in man*, of *reason* as distinguished from mere *instinct*." He is modest in his claims, and intends only a popular treatise, therefore he must not be regarded too harshly.

There is too little coherence in the book to make it an easy task to criticise it as a whole, and the bulk is too great to allow detailed examination. Yet it is soon visible, on perusing the book, that the author's aim is to exalt animals at the expense of man, in opposition to the depreciation with which, by what the author considers human prejudice, they are generally received; though, of course, he does not quarrel with the vast superiority of man in his most complete develop-

ment, he selects the more backward types of the human race —e.g. savages, criminals (whose brutal habits afford the opportunity for sarcasm at our so-called civilisation), idiots, lunatics, &c., for description—to compare with the best examples of the lower animals. Notwithstanding the care with which this comparison is in many respects pursued—and no one can doubt the honesty of the author, though, perhaps, his enthusiasm may be a little mis-directed—there seems a good deal of the art of the advocate in place of the strict impartiality of an inquirer after truth; there is the truth, but not the whole truth. The method and plan employed are, unfortunately, by no means innocent of logical faults; one of the most serious being too common in the scientific examination of a system—such as the mind—of instituting a comparison piecemeal, of each pair of elements in isolation, apart from their relation to the rest of the system. Thus the structure formed by the parts in combination, which is really almost the sole object of search, eludes observation, just as the soul has evaded the anatomist's knife; so that although it might be proved that in certain single characteristics or aspects the excellence might belong to the member of the more humble class, yet it by no means follows that the total mind of the animal in question will equally bear the palm. Scarcely any attention is paid to the important fact that man possesses a larger number of highly-varied and nearly always more highly-developed faculties, and a versatility in their application that is peculiar to himself. Further, the reader feels oppressed by a strained analogy throughout the book—what is outwardly similar being regarded as essentially identical—perhaps to meet preconceived views as to the resemblance, the chief form this takes being the fallacy of anthropomorphism, animals being credited with human motives, on which subject he remarks (Vol. I. chap. xviii.) that interpretation of motives is very difficult, even in our fellowmen; and he assumes that the "attribution of human motives is both legitimate and necessary" (p. 339). As an example of this we would refer to the case (Vol. II. p. 301) of sporting dogs being described as filled with disgust and contempt, and consequently deserting their master, because of his incompetence

and want of skill as a sportsman; but is it not much more likely that their desertion was due to disappointment at failing to obtain the pleasures of a successful chase? If all such interpretations were admissible, one would be almost persuaded of the possible truth of Æsop's fables! Another frequently-repeated variety of the same error is the confusion of similarities of analogy with those of homology, as well as different stages in the development of a function with one another, for in psychology, not only the quality of a particular sentiment, but also the range of its application—i.e. its intellectual equivalent—must be taken into consideration in estimating its real character. Again, he is apt to confound mere imitativeness with spontaneous efforts at construction, thus assigning too much credit to the imitator; also he does not always appear to attach sufficient importance to the power to adapt means to ends, or to distinguish accurately between the qualities learnt by natural experience and those taught by man.

The work cannot claim pretensions to be a system of comparative psychology, for there is not much philosophical comprehension of a standard of comparison, or a thorough scientific analysis of the mind into its several faculties, to be traced in their grades of development through the several classes of the animal kingdom.

The author discards—perhaps with good reason—any classification of mental faculties at present in vogue, but acknowledges his inability to frame a better.

Instead of this, groups of mental phenomena are taken somewhat promiscuously, according to their outwardly prominent features, to head the different sections and chapters of the book; and these groups are sub-divided arbitrarily, like a catalogue, into various lists of minor qualities, arranged, in rather monotonous series, too much like the objects collected in an ordinary museum. This arbitrary arrangement of so large a quantity of facts is certainly one of the chief obstacles to appreciation of the author's work, for it renders the book somewhat dreary to read, though perhaps it may be in accordance with the Baconian rules for conducting the investigation of nature. It might also be objected with some force that there is as yet insufficient material to pursue a

satisfactory comparison between animal and human minds. The resemblance, here performed somewhat cumbrously, is in tone much like the masterly account given on a smaller scale, with much more justice and eloquence, in Darwin's 'Descent of Man.' To have drawn an adequate picture with predominance of the distinctions above the general agreement would indeed have been invaluable, but, as the author regrets, almost impracticable. We think that failure thoroughly to appreciate the points of difference has led him to exaggerate the fundamental identity.

In introducing the work to his readers, the author describes the method he has endeavoured to employ in its preparation, laying down at length what he considers to be the best rules for conducting scientific research; giving due notice of the chief fallacies to be avoided; so that we presume he assails his task, thus guided and protected, with no want of self-confidence. He says he aims only at laying down facts, but is careful to attest them by reference to and examination of the authorities whence he draws them. We do not feel altogether satisfied with either of these attempts, for such a huge record of facts is greatly diminished in value by being imperfectly digested; and certainly many of them demand a heavy tax on our credulity to obtain acceptance, e.g. that sperm whales communicate with each other at the distance of six or seven miles! (Vol. I. p. 420) although the author declares he has been at pains to verify all his borrowed information. We suppose that it must be from a slip of which the author was unaware that we find the absurdity (Vol. I. p. 420) that, among other animals, the *guinea-pig* uses its tail as a respirator, and to maintain its warmth! The chief sources of the author's information are the works of J. G. Wood, Houzeau, and Pierquin, the Animal World, and current newspapers, besides original observations, for which his extensive travels have given him the opportunity.

In spite of the abundance of matter, we are inclined to believe that more profound studies of fewer cases, and the detailed discussion of intricate, knotty, and interesting problems, would have been more profitable than the mere deposition and enumeration of the mass of facts which overcrowd

these volumes; it must remain a work for consultation rather than for ordinary reading, though not exhaustive enough to constitute a standard work of reference; for we believe that contributions to science—at least in the inexact department of natural history—lose much of their worth by extreme dryness of statement, just as jewels are less esteemed when reduced to powder instead of remaining of larger size, and being duly cut and advantageously set. However, we will gratefully offer at least one fragment of commendation—to the attempt to give an account of the phenomena of mind without constantly referring to unmeaning nerve-cells, &c., for explanation. The first section consists of a brief outline of comparative psychology, showing the increasing mental complexity in the ascent through the invertebrate and vertebrate classes, although the psychological and zoological scales do not coincide. A chapter is given to show how incorrect is the character given to some species of animals by popular estimation; usually worse than they deserve, though sometimes they make more blunders than are expected of them. Chap. ix. contains a list of alleged psychical differences between man and animals; but they are all held to be neither invariably present in man, nor always absent from animals. The popular belief in a sharp demarcation between instinct and reason is strongly contested; every animal is further said to possess a distinct individuality. Some curious familiar subjects are dealt with in chap. xiii., under the head of "Unsolved Problems," including migrations, &c.; but not a very great amount of the light of reason is brought to bear upon it. Then begins the detailed study of the mind in its normal manifestations: the first subject treated of being the moral sense, and in order to draw as near as possible a comparison between its developments in man and animals, its presence in some lower specimens of humanity is at first considered; it is declared to be occasionally absent, perverted in disease, and to decay in old age. A list is given of a large number of features of the moral sense in savages, &c., of many immoral characters present instead. From man, the step is taken to lower animals; but it would have been well to stay to ascertain how far the terms "right" and "wrong" are at all applicable to animals, seeing that the courses of action

among which they have to choose are less numerous and less embarrassing than in the case of man, and especially as the social conditions of the latter give quite a novel direction to his life. The author admits that "what is popularly spoken of as a sense of right and wrong, of legality or illegality, in the lower animals, may, or will, if strictly analysed, be reduced to a distinction between what is *forbidden* and what is *permitted* by man, who is recognised as a sufficient lawgiver and administrator—what will bring *punishment* on the one hand and *reward* on the other" (p. 181). "But," he adds, "this is just the kind of feeling that exists in the savage, the civilised child, the lunatic, or idiot." But he certainly does not show that it becomes so large a portion of the mind, its pursuit so independent, in any animal as in man; he holds that there is no reality in the objection that what are apparently moral acts are not really so. As corroborative of his views of the moral responsibility of animals, he mentions that their acts were formerly so regarded in courts of law; and in extenuation of their would-be faults, he holds that many of them are due to man's ill-training. The same subject is also treated of in other parts of the work, viz. chap. xxii. on Law and Punishment, where it is stated that some animals have rules laid down by authority and custom—a law of right as well as a law of might; they have rights in property and rank. Some birds have apparent judicial proceedings; and there are exhibited a variety of punishments. The obverse of the same question is handled in Vol. II. chap. xi., on Crime and Criminality, showing that they may be guilty of offences against man's or their own laws; their faults being theft and destructiveness, including murder and mutilation, and they are conscious of their criminality. In a chapter on "Sensitiveness" is shown their keen susceptibility to the opinions of their fellows, &c. The ethics of vivisection are not discussed. Next comes an account of the religious feeling—first in man, in whom it is shown that there is sometimes no notion of any Supreme Being; in savages there is fetish and ancestor worship, and hero-worship even in civilised man. Then the religious feeling is stated to exist in many animals; but the proofs of exalted feeling seem scarcely convincing. That many domestic

animals look on man as a god is very likely true; yet, in comparing them with men, it must be recollected how much more easy it is for them to form such an idea, having the object of reverence within reach of their perception. The analogy is surely carried much too far in ascribing attendance at church by dogs to gratification of a religious sentiment! and piety to parrots for repeating prayers!

Next, the capacity for education is discussed, and Ch. X. contains some interesting information of the training required by the young of many species to develope some of even the strongest instinctive aptitudes.

Next the distribution of language is considered. We cannot understand on what grounds it can be held that "animal language is more comprehensive than, and quite as eloquent as, man's." Houzeau's remark also is quoted with approbation, that the language of certain savages is inferior to that of various animals. The author expresses an opinion that a professorship of comparative language should exist in all universities, and due attention given to all forms of expression common to other animals with man. Several pages are occupied with a long alphabetical list of the significations of animal vocal sounds; and it is noteworthy that all are names of states of feeling, thus suggestive of the interjectional origin of language, and of the degree to which the mind must have developed before articulate speech arose. Laughter is shown to be neither universal in, nor peculiar to, man; weeping is an expression of grief common to many animals.

The rest of Vol. I. is devoted to more special phenomena; under the heading of "Adaptiveness," it is shown of what variation the powers of animals admit; what use they make of the members of their own bodies, of natural objects, and man's instruments; that they occasionally delight to clothe themselves, prepare food, and provide themselves with shelter; also that they combine to form societies, with one or other form of government; that they often show considerable acquaintance with numbers and skill in calculation, including the exact appreciation of time. Their habits of courtship and marriage are described; and numerous illustrations are given of the satisfaction of the maternal instinct by foster parentage.

Vol. II. is devoted to morbid phenomena, regarded by the author as of chief importance. As before, the pathology of animals is arrived at through that of man. The use of a knowledge of the subject, besides its scientific interest, is said to be for its great practical benefit, for the author believes that the efficiency of animals as servants of man depends very largely on their mental soundness, especially the training and moral care they receive; he also holds that bodily states depend on mental condition in other ways that will scarcely be believed by many, e.g., that contagious rabies is producible in the dog by exciting passions! and that the milk, blood and flesh of animals may be rendered poisonous by mere protracted suffering.

A likeness is drawn between the symptoms of animal and human insanity, the general course and a number of leading appearances being shown to be common to both, e.g., idiocy, imbecility, acute and chronic mania, with monomania, acute primary, secondary and senile dementia, various morbid impulses, such as kleptomania, erotomania, dipsomania (for many animals acquire a partiality for alcoholic excess), and perversion of the natural affections being often well marked. No mention is made, however, of epilepsy or general paralysis. But in this account of mental arrangement, mere temporary mental disturbance is too much mixed up with genuine insanity. In the matter of sleep and dreams, there seems much evidence of exact similarity between animals and man. Suicide is declared to be as common and as various in its mode of performance as in man! Several chapters are devoted to ætiology, the attempt being made to show that the causes closely correspond in animals and man; they are divided into physical (including physiological and pathological) processes, moral, and mixed.

The final section of the book is occupied with practical conclusions, consisting of directions for the training and care of domestic animals; but we cannot see that many of these rules are deserving of such deliberate and explicit statement in this book; or even that their formal laying down will lead to much practical benefit.

The means for treating animal insanity are also described; but without the mention of anything suggestive or important.

The book concludes with an appendix of a full bibliography, an interminable list of animals referred to, and a long analytical index.

F. L. Benham, M.B.

Des Paralysies dans les Maladies Aiguës. By Dr. L. Landouzy. Paris: Baillière and Co. 8vo., pp. 362.

Under the name of paralysis in acute disease has been collected a vast mass of more or less heterogeneous material, which the author of the present volume has endeavoured to sift and classify as much as possible. Though much remains to be done yet before we can hope to understand thoroughly the multifarious phenomena of febrile akinesiæ, we welcome Dr. Landouzy's work as one likely to hasten that time, were it only by clearing the ground of much ambiguity and many premature theories.

The group of paralyses under consideration is purely a clinical one, and every attempt to reduce them to an artificial unity by calling them paralyses of "convalescence," or of "asthenia," or reducing them to the "diffuse," "peripheric," "amyotrophic," "essential," "reflex," or other types, must necessarily fail. The present volume opens with some general and historical considerations of much interest; but we will at once plunge *in medias res* and follow the author in the clinical description of the paralyses occurring in various acute diseases, and then summarize with him our present notions with reference to their pathogeny and pathology.

Paralytic symptoms after diphtheria are very common, and in no way depend upon the severity or locality of the primary disease. Paterson ('Medical Times and Gazette,' 1866, p. 608) describes an interesting case, in which diphtheritic inoculation at the wrist was followed by paralysis of the four extremities. Curiously enough, the palate muscles escaped. Diphtheria is more frequently followed by paralysis in adults than in children, but the presence of albuminuria does not seem to have any causal relation to the evolution of this symptom.

The first muscles to lose power are usually those of the palate. If the nervous disturbance spreads, the eyes are affected next, then the legs and arms. When the paralysis remains localized, it usually runs a short and favourable course; but if it becomes generalized, recovery is much more protracted, though even then it may disappear in a few weeks. From every point of view, diphtheritic paralysis is characterised by a great mobility of symptoms, though Trousseau has certainly exaggerated this fact. The symptoms more particularly characteristic of a paretical condition of the palate are a nasal twang, difficulty of deglutition, of suction, of blowing, of gargling. The pharynx and larynx may become involved along with the palate. The disturbances referable to vision are due to diminution of the power of accommodation; paralysis of the muscles of the globe are much less frequent.

The legs are more commonly affected than the arms. Hemiplegia has never been shown to follow diphtheria. There are frequently troubles in the sensory sphere, paræsthesiæ, and anæsthesiæ, which may even exist without loss of motor power. Sometimes there is ataxia.

The diaphragm and other respiratory muscles are occasionally involved, as Duchenne so well showed. Dr. Landouzy gives a very interesting case in which this distinguished physician apparently saved the patient's life on several occasions by faradisation; and other cases illustrating the implication of the pneumogastric and consequent cardiac syncope.

Many French writers follow Gubler in describing a non-diphtheritic anginal paralysis. But our author thinks it more probable that the confessedly very rare cases where such a paralysis has been observed were really diphtheritic. The distinction between the diphtheritic and "herpetic" anginæ is sometimes very difficult to uphold, and the course of the paralytical symptoms in both instances is precisely the same.

The paralyses depending on typhoid fever are so various that it is not easy to summarise their symptomatology and pathology. Dr. Landouzy illustrates them copiously with cases which we can only recommend to the attention of our readers. In the majority paralysis occurs during convalescence, and appears as paraplegia or hemiplegia (with aphasia some-

times, especially in children), and is only temporary. The bladder is very often affected. Besides these disturbances, of central origin, typhoid fever may also cause neuritis and myositis, with muscular atrophy.

Dr. Landouzy discusses the pathology of dysenteric paralysis, and thinks that, in the absence of direct proof of an ascending neuritis, the clinical evidence points rather to a primarily myelitic process. On the other hand, the local paralyses (and anæsthesiæ), such as that of the orbicularis palpebrarum observed in the early stage of cholera, would seem to be rather of peripheric origin.

With reference to intermittent fever, two types of paralyses must be distinguished. The first is characterised by a transitory loss of power, intimately bound up with the febrile attack, and by aphasia, with preservation of consciousness. The second is the "hemiplegic" form of the pernicious fever of authors. It is distinguished by the severer nature of the symptoms, which are less readily modified by quinine, and persist after the febrile attack. These paralyses are probably of cortical origin, and have been explained by a mere congestive process; but it is possible that melanæmia is not without influence on their production.

In connection with variola, we occasionally find a paraplegia, or rather a paraparesis, and a number of akinesiæ, all of temporary duration, occurring during the early stage. During convalescence a variety of nervous symptoms may also supervene, both motor and sensory, diffuse or localised, sometimes with muscular atrophy or ataxia. The latter symptom has been lately studied by Kahler and Pick ('Prager Vierteljahrschrift,' 1879). Joffroy found, in a case of post-variolic atrophy of the left arm, the cord apparently healthy, though both nerve and muscles showed signs of advanced degenerative atrophy ('Arch. de Physiologie,' 1879).

Transitory paraplegia has rarely been observed as a sequel of measles. In scarlatina, early paralysis is said to be of grave omen. A case is reported, however ('Med. Times,' 1868), where a child recovered from a generalised paralysis, which supervened in the middle of the disease. The patient, it must be added, was of neurotic disposition: an illustration

of the general proposition that fevers often seize upon the *locus minimæ resistentiæ* of the organism, whence the variety observed in their manifestations. Dr. Landouzy thinks it not unlikely that, apart from actual meningeal growths, there may exist, in acute tuberculosis, a neuritis which would explain the neuralgic symptoms met with in the disease. Sciatica is not uncommon, and Eisenlohr showed it to depend, in a case lately published, on a neuritis of the sciatics.

In acute rheumatism, if we eliminate apparent paralyses and those due to embolism, paralysis due to a direct influence on the cord or nerves is rare, and, when present, fugitive and mobile. It may appear early in the disease or during convalescence.

With reference to the hemiplegias observed in pneumonia, Dr. Landouzy adopts Lépine's view, who explains them by some circulatory disturbance of the brain. They most frequently occur in old people with atheromatous arteries.

The author discusses the question of "reflex" paralyses in relation to the hemiplegias observed in the later stages of pleurisy. Under this rather unfortunate name—reflex applies to *action*, not to the *loss* of action—we include none but the cases where either an autopsy or a very rapid recovery has shown the absence of any serious spinal lesion. In pleurisy some cases of hemiplegia are clearly due to embolism, whilst others are "reflex:" that is, depend upon a centripetal irritation, producing, according to some, an ischæmia, or, according to others, a functional disturbance of the motor cells.

Until 1862, when Charcot and Vulpian published the first observation of the neuritic origin of a paralysis of the palate consecutive to diphtheria, all such akinesiæ were considered as functional or asthenic. From that day records of organic lesions in similar cases became frequent, and in 1878 Déjerine published his conclusions (see 'BRAIN,' Vol. I. p. 226), based on five personal observations. Dr. Landouzy thinks that the conclusions to be deduced from the facts actually before us are that there is a primary interference with the nutrition of the spinal cord, more particularly of its large cells; and, secondary to this, neuritis of the anterior roots,

motor nerves, with consequent paralysis. He considers the time which elapses between the febrile period and that of the paralytic symptoms as one of incubation, so to speak, during which the necessary impregnation of the cord by the poison gradually takes place.

With reference to small-pox, the observations of Westphal show the occurrence of patches of disseminated myelitis. Vulpian also describes a case of variola where atrophy of the deltoid, due probably to a localised poliomyelitis, occurred. But in opposition to the numerous cases where the clinical phenomena of a post-febrile paralysis are such as indicate a lesion of the poliomyelitic or ascending type, there are some observations on record where the most careful post-mortem examination has been completely negative with reference to any spinal lesion, whilst the peripheral nerves were the seat of distinct neuritic changes. Are we to argue from this the direct nature of the peripheral lesion? or does not analogy compel us rather to assume the previous occurrence of primary central lesions to which the neuritic processes were secondary? The slight nature of these lesions, whilst sufficient to explain interference with the trophic functions and consequent peripheral changes, would explain also their early disappearance. Indeed, why should there not be "functional" affections of the trophic, as well as of the motor and sensory, centres?

The author, alluding to the possible action of febrile temperatures in setting up molecular changes in the central grey matter, shows, on the authority of Dr. Renaut, that its hortensia, or pinkish discoloration, so often found after acute disorders, is due to an actual staining by the dissolved hæmoglobin. Might not this substance play the part of a poison, interfering with the nutrition of cells, and giving rise to the various nervous disturbances observed in such cases? It must not be forgotten either that Meynert and other observers have recorded structural changes in the grey matter, resembling in some particulars the alteration produced in myelin by overheating.

With reference to the direct influence of the specific poisons of the various fevers on the nervous centres, Dr. Landouzy thinks that the rachialgia, so characteristic in some cases,

might very well be taken as a proof of its reality. It seems to manifest itself both by immediate "functional" disturbances and secondary "irritative" lesions of the nervous elements. Future researches will have to show the nature of such poisons—in diphtheria, for instance, where figured particles are so constantly found in the blood. The variety in the localizations of such paralyses depends probably less on the acute disease itself than on certain individual predisposing causes. The asthenia of convalescence plays but a very insignificant part in the etiology of post-febrile akinesiæ, the extent of which is frequently quite out of proportion to the severity of the constitutional disturbance. The author discusses the question whether an ascending neuritis can account for the palatal paralysis after diphtheria, and shows that such a theory does not account for the cases where the disease was localized in other parts of the body, such as in wounds of the limbs or trunk, and where, nevertheless, the paralysis began among the muscles of the palate. The whole theory of ascending neuritis (or rather peri-neuritis, as Hayem has shown) is still very doubtful, and Vulpian inclines to think that if peripheral ever set up central changes, it is more probably through a functional disturbance kept up in the cord. The general subordination of the nerve-fibre to its cell, and the fact that section of a nerve, for instance, does not set up descending neuritis, but a peripherical alteration of its fibres, compel us to look on post-febrile neuritis as secondary to central changes rather than direct.

There is an important group of symptoms observed in many fatal cases of diphtheria, and referable to an extension of the paralysis to the branches of the pneumogastric supplying the respiratory and circulatory organs. Professor Revilliod, of Geneva, has expressed himself to the effect that frequently the cause of death after tracheotomy is simply a nervous disturbance. Vaso-motor troubles, changes in the rhythm of the heart, precordial anxiety, syncope, etc., which are frequently observed in acute diseases, may also be due to a morbid condition of the medulla.

From what precedes, the principles which must guide

us in framing our diagnosis and prognosis of paralyses in acute diseases can readily be gathered. Considerable difficulties may occasionally be experienced in individual cases, as similar symptoms may depend upon lesions of different nature, locality, and depth. Muscular atrophy, for instance, may be due to a myositic, neuritic, or myelitic process, the diagnosis of which may be at best doubtful; whilst the prognosis necessarily depends upon an exact knowledge of that process. Duchenne, by the way, is wrong when he describes diphtheritic paralysis as yielding normal electro-muscular reactions. The amyotrophies of febrile disease yield the reactions of degeneration, like all others; but this fact is of little use in distinguishing neuritic from spinal lesions.

In reference to the treatment of febrile akinesiæ, we must remember that in most cases they have a natural tendency towards recovery. The special indications in each case may, however, be fulfilled by acting on general principles.

Before taking leave of Dr. Landouzy's book we must mention a very full bibliographical index, which notably enhances its value. May we express the wish, in conclusion, that in his next edition the author will revise his proofs a little more carefully and remove numerous misspellings? In several places the construction of the sentences also will bear improvement. At page 275 the sense of the second sentence is far from being at once apparent.

A. DE WATTEVILLE.

General Paralysis of the Insane. By WM. JULIUS MICKLE, M.D., M.R.C.P. Lewis, London, 1880.

IT is not often that we meet with a more painstaking author than the one to whom we owe this carefully compiled monograph, or one who more conscientiously records the theories, hypotheses, and the guesses at truth of each and every one who has mingled in the maze of observation, investigation, or interpretation of this most interesting and perplexing disease. If it was not much to the credit of the medical profession that

so remarkable and well-marked a disease as general paralysis should through all the centuries have remained unrecognized until, in the words of our author, "the discovery burst forth with full effulgence in the works of Bayle," in 1822. We fear that the full effulgence has since that time been not a little obscured by rough and rude observation and by rash hypothesis. Every one almost engaged in the custody of the insane appears to have thought that he was able and entitled to make incursions of discovery in this *terra incognita* of pathology, even if he only brought back one pebble to cast upon the cairn of ignorance, which Dr. Mickle has taken so much trouble to count, measure, and describe, that he has scarcely attempted the higher and far more essential task of appraisement and discrimination. Up to the middle of the volume the foot-notes of reference constitute quite a bibliography of authors, many of them unknown, or known only to be mistrusted, and the same profusion of references is continued throughout to such an extent that to anyone not conversant with the personality of its literature, this preamble of opposing facts and discordant opinions greatly detracts from the real merit of the work, which consists in the careful record of the rich experience of its author, and in his generally sound and judicious inferences. Personally we respect Dr. Mickle all the more for this fault of his book, just as we are compelled personally to disesteem the psychological author of the opposite type, who, utterly devoid of all originality, succeeds in writing readable books which are a tissue of the threads of thought stolen from other men. But the pleasant thief may even be more profitable reading than the conscientious compiler, because his art enables us to grasp the ideas which he has assimilated, and thus we may feed upon Milton or upon any other of the monarchs of thought, dished up in a modern *menu*, and we may reflect, as Hamlet did, how that a man may "eat of the fish that hath fed of that worm, that hath eat of a king," to show that "a king may go a progress through the guts of a beggar."

But the fault we find with Dr. Mickle is that he contradicts his name, and makes not enough of himself, by sandwiching his opinions between the coarse bread and the bad butter or the oleomargarine of others. It is with difficulty that we get

a taste of them, yet when we do, the flavour is right, for he is evidently a careful observer and honest thinker, and he has grand opportunities of observing at least the later stages of the disease about which he writes; for Dr. Mickle is the medical superintendent of that proprietary lunatic asylum at Bow which belongs to a private gentleman named Byas, and in which, under the sanction of the Commissioners in Lunacy, the Government causes its soldiers who become insane to be incarcerated. The history of the treatment of insane soldiers deserves to be told. For a time the army authorities borrowed the hospital at Yarmouth from the navy, but when it was wanted for insane sailors, and when, moreover, it had been discovered that soldiers becoming insane could not be got rid of by turning them loose in the streets of Chatham, after the parish authorities had been advised that they must take care to apprehend these loose madmen as not being under proper care and control—then the insane soldiers were farmed out to Mr. Byas, who has had the good sense to employ Dr. Mickle to take care of them. The army has hitherto been supposed to contain its full proportion of intemperate and dissolute men, and as drink and dissipation are supposed to be efficient causes in the production of general paralysis, Dr. Mickle has enjoyed a wide field of observation on the subject of his monograph, of which he has not failed to avail himself.

The first chapter, on what the author calls the Prodromes, valuable as it may be, does not make up for the defect we feel in the more important chapter on Diagnosis that the latter is instituted in regard to the fully developed form of the disease, where small difficulty is usually met with, and little skill required. There are few, if any, of the physical prodromes which may not prove to be precursory signs of other disorders, or which may not pass away without the supervention of any diseases. The most important and significant precursor is "sudden unforeseen moral falls, of which theft is one of the most frequent, which occur to those hitherto without reproach. In the history of many a case do we find that some moral or other mental change in the patient has been noticed long before the recognized onset of the disease." We may observe in passing that these so-called moral falls appear to indicate

general change of the mental faculties, and that this kind of thief does not steal because his desire has overcome his sense of right, but simply because he has misjudged his relation to the property of others. The so-called moral perversion is in truth insidious dementia, notwithstanding the fact that no little ingenuity and design are sometimes displayed in obtaining the proposed end. But in judging of the medical purport of "sudden unforeseen moral falls" without the accompaniment of physical symptoms, the mental physician has great need to beware lest he be used as a cat's-paw on behalf of some real criminal who may for long have broken many or most of the Commandments.

In the important chapter on symptoms, as distinct from precursors, we are dreadfully puzzled to know just where we are, in consequence of the author's habit of running a little way after everyone's lead, and then forsaking it for some new track. The one important thing to do was to fix and define the very earliest symptoms by which this fatal disease can be definitely recognized; but, instead of doing this, the author discusses the stages and periods of the disease according to the diverse opinions of several authors, in whose observations and opinions we should have much less confidence than in his own, if he would only have given them without all this frippery of reference. It is a mistake to describe a continuous disease like General Paralysis as if it had stages like a coach, or even like an exanthematous fever; and it is an abuse of language to discuss periods in a progress where there is but one period—that is, death. That which would be most precious in practice, but which we do not get, would be an original investigation into the earliest trustworthy signs and symptoms, and into the just value of those which are more or less reliable. In default of such guidance, mistakes are constantly being made even by practitioners of some experience, while by the profession at large the early recognition of this disease is a task as hopeless as it is important. In default of such knowledge, it can be no matter of surprise that the chapter on Diagnosis points to the roughest discrimination from the most unlike diseases. It may be worth while to tell a man that if he walks upon his own shadow he will not go to the south

in these latitudes; but in medicine an exact semeiology is a mariner's compass which supersedes the need of such rough directions; and for once in a way the author does object to one of his recent authorities, Voisin, for including senile dementia in General Paralysis, and to the "regrettable tendency in this direction, with the result of thrusting into the domain of general paralysis a host of various senile cases alien to it."

In his account of the microscopical appearances, as described by Mierzejewski and others, the author says:—

"So great is the variety of morbid appearances described, and of the localities said to be principally affected, that I propose to trace the changes throughout the whole central nervous system, beginning at the brain as a matter of convenience, and without prejudice as to what part of the nervous system is the primary or principal seat of the disease—a question as to which the most conflicting replies have been returned by workers in nervous pathology. With facility one might dogmatize; but in the present imperfect and shifting state of our knowledge, I think it better to quote several observations, even at the risk of being thought tedious."

Therefore with regard to the Pathology and the Pathological Physiology, we are duly informed of the views entertained by Lubinoff, Luys, Lionville, Lasèque, Linas, Landors, Lusana, Lemoine, Landouzy, and other writers of as great authority; the result being that "our attention is claimed by a conflict of opinion as to whether the essential pathological change in general paralysis is principally and primarily of a more or less frank inflammatory nature, or principally and primarily of a degenerative nature." And it is no wonder that the author concludes that, "confronted with these various and often irreconcilable views, we may proceed to examine the subject anew." The wonder rather is that he should have imitated the frequent habit of many insane patients by such promiscuous accumulation.

Forced in this manner to examine the subject anew, the author proposes a view of his own, which is that "the morbid process in the nervous system first deranges and then destroys, or tends to destroy, the functions of the parts affected.

"In the vast majority of cases the cerebral cortex is

primarily affected, the meninges usually being more or less involved almost simultaneously; in many cases the morbid process is most active in circumscribed regions; the convolutions of the frontal and parietal lobes suffer more than other parts." There is repeated and more or less persistent cerebro-meningeal hyperæmia; distention of the vessels, circulatory impediments, irritative over-growth of the connective nuclei of the walls of the vessels, and probably also of the neuroglia; while others of the nuclei and cellules, often termed embryoplastic, or their materials, are perhaps directly effused. Other changes from the lowered standard of the local processes of nutrition are wandering of white blood-corpuscles, and escape or extravasation of red blood-corpuscles; tendency to diffuseness of all the morbid processes, and thickening opacity and œdema of the superjacent meninges; the nerve-cells failing in their nutrition, and hence their swelling cloudiness and final degeneration. Then, if a chronic, mild, adhesive form of inflammation sets in, fibrinous effusions and production of connective tissue assist in more completely involving the nerve-cells and in tying down the membranes to the cortex. "These changes proceed in the usual degenerative course, and finally, as a result of them, we find the processes of the nerve-cells cut off by the way—the cells themselves atrophic and degenerate—the blood-vessels fatty, calcareous, pigmented, and misshapen, and the former hyperplastic neuroglia now atrophied."

Such is the author's "own view," somewhat abbreviated, of the pathological changes; and this "own view," as it bears upon the course of the disease, is continued for many pages well worth reading and reflecting upon. We can only regret that the volume does not contain a much larger proportion of statements, suggestions, and opinions from the same source. The chapter on Therapeutics, which comes to us nearly undiluted by references, is very sound and sensible. The author thinks highly of veratrum viride during the earlier periods, and of perchloride of iron throughout; and he thinks prolonged artificial suppuration likely to do good, but has not had the courage to try. We have frequently used it, and have been convinced the progress of the disease was

retarded thereby; but, like Dr. Mickle, we have never seen any treatment followed by any better result than a temporary remission of symptoms. Still there can be no doubt that appropriate treatment will greatly diminish the apparent sufferings of the patient, or at least render them less inconvenient and distressing to those about him.

The volume is concluded by a small-type Appendix of cases, in which the author attempts to establish five varieties of the disease, and it forms a valuable record of well-observed facts. It seems to be pretty certain that there are no kinds of general paralysis distinct from each other. Every case is dissimilar, within certain limits, from all other cases, but it may be doubted whether each group does not pass by insensible gradations into other groups; and the author fully recognizes the principle that the essential pathological process is not multiform; and if he only makes use of his attempt to group the individual cases as a means of investigating the causes of their difference, the labour may be well repaid. During further inquiry he will probably have to rearrange his groups many times, in order to make them fit in with the varying facts he may meet with. The groups Nos. 3 and 4 seem to be mainly based upon the encephalic localities of the pathological changes. No. 2, upon the chronicity and mildness of the disease. No. 5, upon a local cortical induration. No. 1, upon generalized and symmetrical affections of the hemispheres, with adhesion and decortication of the cerebellum, but the plan is too complex to promise success as a method of investigation. The groups should have been formed on some consistent plan: for instance, the localities affected, or the kinds of morbid process. Grouping in a methodical manner is by no means an inefficient means of investigation, but grouping according to any characteristics of the most diverse kind which seemingly present themselves will be likely to disappoint the hopes and efforts of the observer.

JOHN CHARLES BUCKNILL.

Clinical Cases.

CASE OF MICROCEPHALIC IDIOCY.

BY A. R. URQUHART, M.D.,

Medical-Superintendent, Murray's Royal Asylum, Perth.

In addition to the two cases of Microcephalic Idiocy described by Dr. H. R. O. Sankey in this Journal ('Brain,' October 1878), there is at present a third patient similarly affected under the care of Dr. Parsey (Warwick County Asylum).

E. F. was admitted into the Warwick County Asylum on the 20th of September, 1876, from a remote workhouse, where she had been detained for five years.

Mr. Hitchens, of Shipston-on-Stour, has kindly obtained the following facts from her father. Her parents were not related before marriage, and were of average intelligence, sober and industrious. Her father is now seventy-four years of age, a hale old field-worker. Her mother died of phthisis twenty-five years ago, was always delicate, and for the last fifteen years of her life did but little work.

She had seven children, three—still alive and without mental defect—born before E. F. Two born after E. F. were also healthy, but one of them died, æt. 16, of rheumatic fever. The last child was seven years younger than the patient, and had an abnormally small head, though not so small as hers. This girl had more intellectual capacity than E. F., but she never walked, and suffered from general marasmus till her death, when nine years old.

The family, as a rule, appear to be fairly healthy. The only ascertained history of nervous disease occurred in a niece of the mother's, who had a paralytic seizure.

During Mrs. F.'s pregnancy with E. F. she had no disease, and met with no accident; and there is no history of any extraordinary maternal impression. At birth the cranium of E. F. was noticed to be very small, the medical attendant stating that her brains were all in the back of her head.

When in the workhouse she was very passionate, noisy, and excitable; and was reported in the certificate of insanity to be getting more unmanageable.

On her admission she was in a similar condition to her present state, though during her residence here she has become quieter and more tractable, and has also improved in her habits.

She is now forty years of age, but looks considerably older. Her attitude is peculiar. She perches herself on the edge of a chair in a simian posture, the hands being invariably crossed on the breast, constantly intertwining in a nerveless, purposeless way to an accompaniment of a rhythmical swaying of the body to and fro. Her back is bent till her head appears to be set on at right angles to her body, and her neck is usually on the full stretch; she is either craning forward in her contortions or her head is bent down to the utmost. In summer her chosen place is by the corridor door, in winter hard by the fire. She is shrivelled and aged-looking. The wrinkles on her face are deep, and her breasts are withered and pendulous. She is slightly built, with small bones, and insignificant muscular development. Her habit of stooping has brought her shoulders forward to the utmost, but otherwise she presents no extraordinary deformity of body or limbs, save for a slight inequality in the length of forearm and hand—the right being the longer by half an inch. Her head at once attracts attention by its minute size, which somewhat luxuriant grey hair is perfectly inadequate to compensate for. Her complexion is sallow, and her expression in repose fatuous in the extreme. At other times it varies between fear and pleasure, rarely showing attention or curiosity.

The shape of her head is oxycephalic, tapering to a cone-like summit. Her nose is long and prominent, surmounted by well-developed frontal sinuses, immediately above which the frontal bone bends suddenly backwards, and slants upwards on a parallel plane with the nose. The remaining upper incisors project from the alveolus and the chin suddenly retreats beneath a wide and capacious mouth. The cheek-bones form the widest part of the face. The occipital spine is boldly marked, and forms an excellent tubercle for measuring from. The cranial sutures are closed.

She walks in an exceedingly clumsy manner, lifting her feet high from the ground and rolling at each step. She runs but seldom, and when she does, it is with an indescribable shuffle, with head thrust out in front and a feeling of tottering insecurity. All her motions are clumsy and express a want of co-ordinating power. Notwithstanding she possesses a fair amount of strength, and in anger has been known to pull

another patient down on the floor. Her grasp is apparently feeble under ordinary circumstances, and her intelligence so limited that she cannot exert it on command. It is easy, for instance, to pull a tea-cup out of her hands, but the nurses sometimes find it rather difficult to persuade her to enter a bathroom-door. She claps her hands sometimes, but without eliciting much noise. Though ravenous at meal times, her haste in eating is owing to the quantities she stuffs in her mouth, not to the rapidity of arm motion.

Her days are spent sitting, as above described, on a chair, from which she very rarely moves unless when summoned to meals or to bed. She is passionate when tormented, but appears on the whole to be of an amiable temper, with the characteristic confiding simplicity of idiocy.

With regard to her bodily condition, she is in fair health. On her admission she was often sick after food, but now this rarely happens. Her tongue is clean and moist, her appetite good, her bowels regular. The teeth are yellow and chalky, and several have dropped out. The palate is low and smooth. Her skin is moist and free from eruptions.

The organs of circulation present the usual characteristics of congenital idiocy. The pulse is slow, weak and small. The heart's impulse is feeble, the sounds normal. The feebleness of circulation is manifested by the constant swelling, œdema, and lividity of the feet and legs, which sometimes indeed necessitates her detention in bed.

Respiratory organs apparently normal. The inspiration is extremely shallow and feeble.

She used to menstruate at irregular intervals till about three years ago, when the catamenia suddenly ceased for six months, at the end of which time she suffered from a menorrhagic attack, after which all menstruation ceased. She has never been known to manifest any sexual feelings. Her genital organs are apparently normal. Her sight is intact, for long and short range of vision. Hearing is also apparently perfect. Smell is but feebly developed. Taste is evidently present—she prefers bread and treacle to bread and butter—and touch is sensitive if not indeed hyperæsthetic.

Her intelligence is extremely low. She recognises strangers, if in a different garb to the ordinary asylum dress; and she knows, at any rate, one patient who is her especial aversion. She recognises her name, also simple words and phrases—as, dinner, bed, bath, music, &c.—but her vocabulary is extremely limited.

She is perfectly helpless in regard to dressing herself. The only use she can make of her hands is in feeding; she can use a spoon.

Her language is confined to interjections; her whole stock being, "Oh dear!" "Now then!" "Ah = Yes!" "Hulloa!" "Ah!" and "No." And these are pronounced so indistinctly that it requires some experience to determine which is which. When asked to go to the bath, she will sometimes say "No." She is fond of pretending that she is ill, saying, "Ah!" with indrawn breath and a very good imitation of suffering expressed by hands pressed on stomach and piteous noise.

Attention is hardly present. It requires considerable motor power to rouse her attention, and then it is but a momentary exhibition. For instance, she can be roused to scream at the sight of a penknife being opened, but would take no notice of a dog in unaccustomed attitudes.

There does not appear to be any imitative faculty in force.

She has no fund of amusements, no fondness for any toy or ornament. A doll will lie in her lap unheeded, and picture-books are beyond her range entirely.

She seems to have a preference for little children, and has on more than one occasion given them portions of bread and butter.

Her memory is certainly rudimentary. She remembers having an abscess in her leg opened by a lancet two years ago—witness her screams on seeing a penknife; she certainly recognises tape and callipers, and has a lively recollection of my stealing her bread and butter at tea.

Her fondness for music is remarkable. This is evidently not a mere liking for noises; but she can really appreciate musical rhythm. Her great delight is to hear the band play, and when the music is in full swing her contortions are most pronounced, and her grunty noises are at their loudest.

Identity is present—evidenced by her knowledge of her own ward, her own bed, and her own seat.

She would pay no attention to the calls of nature; and is only preserved clean by being taken to the closet daily. She never makes any attempt to find her way there herself, but when there gives no farther trouble.

She is very timid and easily frightened.

Exhibits no affection or preference for any single patient. In fact her habits are perfectly solitary.

She still continues very passionate, though her opportunities of showing this have been much diminished. She is also revengeful as regards one fellow-patient only. This girl has a most objectionable habit of staring into her neighbours' faces from a very close proximity, and E. F. will at once take the offensive on her approach. With an evident memory of former encounters, she makes hideous noises

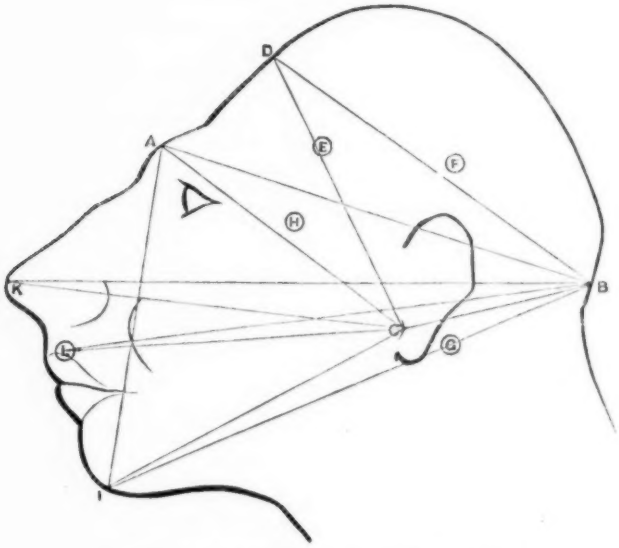
and clutches at the object of her wrath with a ferocity that could scarcely be credited to her slight figure and nerveless fingers.

Occasionally, though now not so frequently as in former years, she lies down, refuses to move, and has to be carried to bed.

Curiosity is very faintly developed.

Pleasure is manifested by smiles and a quickened rocking of the body, and a more rapid interlacing of fingers. This is chiefly manifested on hearing music.

She often exhibits mortification and jealousy when she is overlooked by the nurse or her fellow-patients going out to the garden. At these times she becomes noisy, and is only pacified on being allowed to join her neighbours.



DIAGRAM—HALF LIFE SIZE—OF HEAD MEASUREMENTS.

Sympathy, and all the more complex psychical phenomena are quite beyond her ken. In fact her mental capacity might be rudely gauged at something below that of a fairly intelligent house-dog.

She sleeps in the fœtal position, covered entirely by the bedclothes.

MEASUREMENTS.

Height		4 feet 9½ inches.	
Weight		85 lb.	
Head. Curves	Circumference (A B)	16½	inches.
	Antero-posterior (A B)	9	,,
	Bi-auricular (C C)	10	,,
Forehead	Breadth (E E)	3⅞	,,
	Height (A D)	1½	,,
Diameter	Longitudinal (A B)	5¾	,,
	Transverse (F F)	4½	,,
	Bimastoid (G G)	4	,,
	Bizygomatic (H H)	4½	,,
	Fronto-mental (A I)	4	,,
	Occipito-frontal (B D)	5½	,,
	Occipito-superciliar (B A)	5¾	,,
	Occipito-nasal (B K)	7¼	,,
	Occipito-alveolar (B L)	6¾	,,
Callipers	Tragus to chin (C I)	4½	,,
	,, Alveolus (C L)	4½	,,
	,, Nasal prominence (C K)	5	,,
	,, Superciliary ridge (C A)	4⅛	,,
	,, Top of forehead (C D)	4½	,,
	,, Occiput (C B)	3½	,,
Curves	,, Chin (C I)	5¼	,,
	,, Alveolus (C L)	4¾	,,
	,, Tip of nose (C K)	5¼	,,
	,, Superciliary ridge (C A)	4¾	,,
	,, Top of forehead (C D)	4⅛	,,
	,, Occiput (C B)	4½	,,
Palate width		1⅞	inches.
Ears Length		2⅝	,,
Ears Breadth		1½	,,
Length of Arm		11	,,
,, Forearm		9	,,
,, Hand		6½	,,
,, Thigh		16½	,,
,, Leg		17½	,,
,, Foot		8½	,,
Round Arm		7½	,,
,, Calf		10½	,,
Width of Shoulders		10⅛	,,
,, Pelvis		10½	,,

CASE OF CEREBRAL TUMOUR.

BY ARTHUR W. FOX, M.B.

Physician to the Eastern Dispensary, and Bellott's Mineral-Water Hospital, Bath,

and

ERNEST FIELD, M.B.

Physician to the Eastern Dispensary, Bath.

H., a shoemaker, aged 42 years, consulted me on September 14th, 1878. He was of middle height, muscular build, pale complexion, and had a stolid expression of countenance.

He stated that nine years ago, when he was fighting with another man, he tumbled down and was unconscious, but that he was not knocked down. His wife informed me that the true version of the story was, that he had been playing at cards with some other men, when a quarrel arose, which ended in his being knocked down and kicked violently in the head, and that he was so stunned as to be unconscious for a long time. Two years and a half ago, when at breakfast, his "face turned very pale, and his lips black," but he was not unconscious, neither had he headache, or twitching of his limbs, but he felt giddy. Since then he has often had these "pale fits," sometimes as many as two or three attacks in a day. On one occasion a fortnight elapsed without his having any. He was obliged to give up work a fortnight before Christmas, 1877, on account of violent pain in his head in the frontal region; for this he became an out-patient at the United Hospital, when, as he required to be visited at his own home, he was under the care of Dr. Field, who found, upon examination of his optic discs, double optic neuritis; and, coupling this fact with the violent headache, he formed the opinion that the case was one of cerebral tumour.

The patient was able to read up to the date of a month before Christmas, 1877; since then he has gradually become blind. There was no history whatever of syphilis, but he had gonorrhœa many years ago. He drank to excess when he was

younger, but has not done so for years. His mother died of phthisis, and he has a cousin insane.

Present State.—Mr. Mason, who recently examined his eyes at the eye infirmary, describes his discs as in a state of white atrophy. His pupils are contracted, equal. Smell unmistakably blunted on both sides. Taste fair. Hearing good. Memory affected as to recent events, but good for what happened some time ago. Sleeps well. Complains of constant headache in frontal, and to some extent parietal region, but he is no longer liable to the violent paroxysmal exacerbations he suffered from when he was under Dr. Field's notice. Tongue protruded straight, and moved well in all directions; organ in a state of fibrillary tremor. No appreciable tremor of palate. No affection of speech. No nystagmus. Fine tremor of both arms, which grows coarser upon an attempt at voluntary movement. Grasp of hands equal. No paralysis of face, limbs, or sphincters. This is neither anæsthesia nor hyperæsthesia. The reflex excitability of skin and tendons is normal. Although blind, he is able to touch with precision various parts of his face and body. Appetite good; never any nausea. Bowels regular. Urine, specific gravity, 1027; trace of sugar. Other systems apparently normal.

October 2nd. Had a severe general convulsion. When I saw him he had regained consciousness; he complained of severe pain in his head in the frontal region. His face and head were dripping with perspiration.

November 3rd. According to his wife's statement, he had an attack without convulsion, in which he was unconscious; when I saw him, shortly afterwards, he was quite conscious. In addition to the usual tremor of his arms, there was general tremor of head and body; no nystagmus.

November 11th. Another severe fit, in which he was unconscious. His wife described it as follows: First, rigidity of both legs, but the right leg the most rigid; left arm flexed and rigid; head bent forward: this was followed by shaking all over. Unfortunately there is no note of the period when he became unconscious. His breathing was loudly stertorous. When I saw him, half an hour afterwards, he had regained consciousness. There was no paralysis, but there was a coarse tremor of arms and legs; none of head, and no nystagmus. Nothing could convince him that he was in his own house.

December 2nd. Vomited. In the evening had a severe convulsive seizure, and was a long time unconscious. At the commencement there was rigidity of both legs, and both arms were flexed.

January 21st. Has lately had what his wife terms "sleepy fits," and several of his former "white fits." Her description of

a general convulsive attack he had to-day is as follows: "His face first reddened, and he then became unconscious. His eyes protruded, and his face became pale. His eyes then rolled, and, at the same time, his limbs became rigid. This was followed by shaking all over." His wife also told me that when he is in his sleepy fits, in which he is only partially unconscious, his "head is drawn backwards when the fits begin," and at the same time he has a "twitching of his left shoulder." She describes it as an upward movement. When I saw him some time after his severe attack, he told me that he had no headache; he appeared much as usual. His wife states that when he walks he tends to fall backwards. He had some difficulty to-day in passing water.

April 11th. Has lately had several "sleepy fits" and "white fits," but has had no seizure in which he has been completely unconscious. The tremor of his arms and the fibrillary tremor of his tongue remain about the same as when I first saw him. On this occasion the tremor of right arms is coarser than that of left. Grasp of right hand stronger than that of left. Recently, when he has wished to pass water, he has occasionally been unable to do so, but when the stream comes he is unable to control it.

From this date I never saw him again, as he went into the union under the care of my friend Mr. Biggs. I learnt subsequently, that during his residence in the union, he complained but seldom, if ever, of headache, and he became very fat. He had no paralysis. He was happy, but had a delusion that he had been at home "mending and making boots," and "that he was put in the wrong bed,"—an old delusion of his. He never had any delusions of grandeur, or apparently any feeling of exaltation. He died in a general convulsive seizure on March 25th, 1880, at 6.30 A.M.

The post-mortem was made fifty-three hours after death, on March 29th, by Dr. Field, in the presence of Mr. Biggs and myself. The following account is taken from Dr. Field's notes: —Scalp very thick, much congestion of vessels. Cranium moderately thick and hard, contents tightly packed; some flattening of convolutions, vessels of membranes full. Whole brain rather firmer than normal, but anterior right half of hemisphere very hard. On making horizontal sections through the right hemisphere, a cribriform appearance was seen in the white matter covering the corpus striatum, and this was still more marked in the septum separating the anterior part of the two lateral ventricles, where cystoid spaces existed in numbers, some the size of a threepenny piece, and one that of a sixpence; these spaces contained a colourless fluid. The cribriform tissue was much thickened, and much firmer than the rest of the brain.

The right corpus striatum was very hard, and larger than the left, but in colour was normal, as if produced by an increase of the connective tissue. Part of the orbital convolution on the right side, bordering upon the Sylvian fissure, was pushed out into a protuberance, resembling an epithelioma in shape, and was composed of the same firm tissue as the other hardened parts. The hardening excavating process had extended slightly to the tissue covering the left corpus striatum, but it was only slightly marked as compared with the right side. All other parts of the brain, the cerebellum, and the vessels, were normal. The optic nerves were normal in appearance, not hardened. The growth in the right corpus striatum consisted of numerous small granules disposed in a stroma of fine reticulated connective tissue: in the unstained sections the structure could with difficulty be made out; but logwood at once differentiated the elements, and rendered the nature of the growth evident. The general appearance of the tissue was quite that of a hyperplasia of the neuroglia normally existing between the nerve elements, and differed considerably from that presented by a round celled sarcoma, with which glioma is frequently considered to be identical: the small cells of which the growth was mainly composed exactly resembling the granules of the neuroglia, and being much less in size than the majority of the cells met with in sarcomatous tumours. The enlarged orbital convolution had the same structure as the right corpus striatum.

Remarks.—There are but few remarks to make upon this interesting case; and I must confess to having been in considerable doubt as to the nature and situation of the cerebral lesion.

That coarse intra-cranial disease in all probability existed was clearly shown by the history of the patient, his headache and double optic neuritis, though the presence of the latter does not invariably indicate some adventitious intra-cranial product, as has been pointed out both by Drs. Stephen Mackenzie [1] and Hughlings-Jackson.[2] Regarding the etiology of the case, there was certainly no history of syphilis, for I carefully went into the question; and a tubercular tumour appeared to me to be excluded on account of his age, the absence of pyrexia and of symptoms pointing to tuberculosis of other organs; also the long duration of the disease, and the fact of his gaining in condition. As to carcinoma it only required to be thought of to be at once rejected. On the whole I was inclined to look upon his symptoms as probably due to a glioma, or to some

[1] 'Brain,' July number, 1879, p. 217.

[2] The Royal Ophthalmic Hospital Report, vol. viii., pt. iii. p. 445.

sclerotic process; in favour of glioma was the long duration of the disease, and his maintaining his state of good nutrition. With regard to the localization of the disease, it was impossible, in my opinion, to come to any conclusion, as the only constant motor symptom was the fine tremor of arms, legs, and tongue, which became coarser upon an attempt at voluntary movement, and in that respect resembling the tremor of multiple sclerosis, but differing from it in the smallness of the oscillation, and, with the exception of the tongue, as a rule not extending to the head. It certainly appears to be a remarkable fact, considering the position of the growth, more especially its infiltrating the right corpus striatum, that he had no hemiplegia, and, excepting on the occasion when I last examined him (April 11th, 1879), any diminished power in the grasp of the left hand, but it only confirms Obernier's[1] statement, that the intensity of the symptoms produced by a cerebral tumour are in direct ratio with the rapidity of its growth, and vary greatly according to individual irritability; also it is impossible to compare slow growing tumours, which may press aside without destroying nerve paths, with those lesions, which in their rapid march destroy whole territories of the central nervous system. The mental symptoms exhibited by this patient were partly due, I imagine, to the changes we found in the profrontal lobes (orbital convolution); as injuries, and diseases of that region, according to Dr. Ferrier,[2] are not followed by paralysis of motion or sensation, but by psychical disturbances of various kinds. The partial bilateral anosmia, I believe, was simply the result of brain squeezing.

[1] 'Cyclopædia of Medicine,' Von Ziemssen, vol. xii. p. 241, 243, 264.

[2] Dr. Ferrier, 'Gulstonian Lectures on the Localization of Cerebral Diseases.'

(Read before the Bath Pathological and Clinical Society.)

Abstracts of British and Foreign Journals.

Method of Preserving the Brain.—Professor Carlo Giacomini of Turin has lately described a process for the preservation of the Brain and Nerves which promises to be of great utility to the anatomist and pathologist. The description of the process was communicated to the Royal Academy of Medicine of Turin on the 7th June 1879, and as I lately had an opportunity of seeing the results of the method employed, and was much impressed with its success, I think some account of it may be interesting to the readers of this journal.

After referring to the various methods previously proposed, such as, 1, the plan of Broca (1860), of hardening in nitric acid diluted with nine parts of water, and subsequent desiccation; 2, that of Frederig of Ghent, modified by Duval of Paris, of successive immersion in dilute nitric acid, chromate of potash, alcohol and liquid paraffin; and 3, the plan of l'Oré of Bordeaux, by immersion in alcohol, subjection to a temperature of 45° C. for 15 or 20 hours, varnishing with gum elastic, and finally electroplating, and stating the insufficiency of them all for the convenient preservation and subsequent examination of the brain, Professor Giacomini explains the manner in which, from a knowledge of the properties of glycerine, he was led to make use of this substance for the preservation in the moist state of brains which had been previously indurated by other reagents.

The primary induration of the brain may be effected by one or other of several reagents, such as chloride of zinc, chromate of potash, or chromic acid solutions, diluted nitric acid or alcohol, but of all these the saturated solution of chloride of zinc appears for several reasons to be the best.

The newly extracted brain is placed in a saturated solution of the chloride of zinc, with the membranes still adhering to it; and after an immersion for about 48 hours the membranes and blood-

vessels may with ease be removed, care being taken to preserve the surface as entire as possible. The brain at first naturally floats in the solution, so that it must be turned in it from time to time till the whole is acted upon, and from the increase in specific gravity it at last sinks in the solution. This generally occurs after two or three days' further immersion, and then the brain is to be transferred from the solution to alcohol of commerce. By this part of the process the brain loses about a twentieth or twenty-fifth part of its weight.

Should there be reason to believe that the brain has suffered from the body having been kept too long after death, or if it is wished to examine it *in situ*, the induration may be effected by the injection of 600 grammes of the saturated chloride of zinc solution into the internal carotid arteries.

The brain when transferred to the alcohol sinks in that fluid, and precautions must be taken, by frequently changing its position, to prevent any alteration of form by pressure against the sides or bottom of the vessel in which it is laid. After remaining ten or twelve days in the alcohol, the brain is ready to be transferred to glycerine.

For this purpose white or colourless fenicated glycerine (in the proportion of 1 to 100) is found to answer best. The brain must remain in the glycerine for a number of days till it is thoroughly impregnated with it, when it will be found to have regained from 5 to 6½ oz. in weight. It is then removed from the glycerine, and placed in any convenient situation, to allow of some desiccation and the exudation of superfluous fluid, and it may either be preserved in this state, or, what is better, it may be covered with one or more layers of a varnish of caoutchouc or marine glue, which, while it does not materially alter its appearance or consistence, protects the surface from the adhesion of dust and from mechanical injury, and enables the preparation to be handled pretty freely without risk of breaking the surface. The final varnishing is not however necessary if the preparations are otherwise fully protected.

Preparations made after the manner now described may be kept for years in close glass or other cases without change; and such is the hygroscopic property of the glycerine that they may even be left exposed for a considerable time in ordinary states of the atmosphere without undergoing any marked alteration in weight or appearance. The natural form and colour of the brain are in great measure maintained, and even the distinction of the grey and

white substance, and the fibrous character of the latter are preserved in such a manner that thin slices can be made and dissections of the preserved brains, much in the same way as in a fresh brain, or in one which has been successfully preserved in alcohol.

It is true the microscopic characters of minute structure are not perfectly preserved; but this could not have been expected from any other methods than those adopted by histologists in their improved modern processes. But for the conservation of series of human brains and those of animals for purposes of exhibition and demonstration, and for the study of the external form and larger structure, they are admirably adapted and likely to prove most valuable, for they remain to some extent soft and pliable, can be handled with freedom, and may be dissected or examined in every way that may be desired.

It is obvious that series of brains so preserved are remarkably well adapted for the study of the comparative anatomy and homology of the sulci and convolutions both in man and animals, and that they are equally well suited for serving as records of the local effects of pathological changes or of physiological experiments.

It seems unnecessary to follow Professor Giacomini further in his description of the varieties in his method of preliminary hardening by other reagents, such as chromate of potash, chromic acid, &c., as that by means of the chloride of zinc appears to be on the whole the simplest and most satisfactory.

I may mention further that in the Anatomical Museum of the University of Turin I saw also with Professor Giacomini elaborate isolated dissections of the whole and parts of the central nervous system, in connection with the brain and spinal marrow and with the nerve roots, ganglia and plexuses, and the anastomoses and subdivision of branches of nerves displayed with great beauty and accuracy, and all preserved in the moist condition after the same manner as the brain preparations, and exhibited under glass covers; and I could not but regard these as most useful and illustrative preparations both for demonstration and study, and especially as immeasurably superior to the older preparations of the same kind in the dried condition.

ALLEN THOMSON.

Krueg on the Sulci of the Zonoplacental Mammalian Brain. (*Zeitsch. für wissenschaft. Zoologie*, Bd. 23. 5 Plates.)—In

this memoir, relating chiefly to the carnivora, the cerebral sulci are divided into three groups.

1. Boundary-sulci (Grenzfurchen) (three in number) which divide the hemisphere into histologically different regions, and which are constant, not only in carnivora, but in all mammals, whether smooth-brained or not.

2. Primary sulci (nine in number), which are present in all species of carnivora without exception.

3. Secondary sulci (thirteen), which are variously arranged in different groups, and in some are accessory or wanting altogether. The individual families of the carnivora may be identified with tolerable precision by the presence and disposition of these secondary sulci.

Further, Krueg indicates homologies between the sulci of the carnivora and ungulata, and renders possible a thorough-going comparison between these large mammalian groups. The work is based on the developmental history of the cat and dog. In addition there are depicted in the plates the brains of forty-seven different species.

H. Obersteiner.

Sur le Développement du Cerveau, &c. Ch. Féré. (*Revue d'Anthropologie*, 1879, No. 3, p. 661.)—The author gives measurements of certain cranio-cerebral relations in the fœtus and young child (sixty subjects), with especial reference to the relative development of cerebral regions. By his method pegs are inserted through the fontanelles to assist in maintaining the normal relations, and the parietals are reflected outwards; the falx prevents separation of the frontal and occipital, and so maintains the ant. post. diameter of the brain, while the bulging lateral diameter can be temporarily restored by replacing the parietals. Topography is not satisfactory before the 5th fœtal month; at the 6th, the fissure of Rolando is unmistakable. Contrary to what has been affirmed this fissure is throughout *posterior* to the coronal suture, and converges to it from above downwards, as in the adult. The Sylvian fissure passes *above* the squamosal bone, and the parieto-occipital fissure lies *in front* of the lambda—while in adults the Sylvian f. very nearly follows the ant. sup. half of the squamous border, and the lambda is nearly always on a level with the parieto-occipital f. From these relations Féré inclines to think that in the infantile brain the occipito-spheno-temporal region, "the sensory and vegetative region" takes precedence in growth, and is relatively more

voluminous than the parieto-frontal or "psycho-motor region;" that is, if the altered relations be due to unequal development of the contained organ and not of the containing cavity—a proviso that diminishes the significance of the observed facts. In adult life the relations between sutures and fissures continue invariable; we have seen that the occipital and temporo-sphenoidal lobes appear to maintain the same limits as the bones they lie beneath, and we might be tempted to presume a parallelism between a cerebral region and its cranial cover.

Amidon on the Effect of willed Muscular Movements on the Temperature of the Head: new Study of Cerebral Cortical Localization. (*New York Arch. of Med., April* 1880.)—Lombard, in 1867, was the first to investigate the relation between mental effort and cerebral, or rather suprajacent cranial, temperature; he employed a thermo-electric apparatus showing variations of less than $\frac{1}{1000}$° F., and thus demonstrated a rise of temperature in the head and fall in the legs with various attractions and efforts of attention. Since that time the subject has been pursued, both as regards parts of the brain or suprajacent parts of the cranium, by a series of observers, Schiff, Broca, Gray, Maragliano, Séguin, &c.

The present paper, to which a prize has been awarded by the New York College of Surgeons and Physicians, is an outcome of the supposition that with the exercise of a peripheral group of muscles, heat generated in cortical centres might manifest itself to surface thermometers placed on the scalp; the writer relates the striking result of a preliminary experiment to test this view: "Surface thermometers were arranged in a strap passing across the vertex, where the centre of the arm was thought to be. After 15 m. the temperatures were recorded; violent flexion and extension of the forearm was then kept up for 10 m.; the temperatures now taken showed that a rise of more than 1° F. had taken place over the centre for the arm on the left side of the head only." The following are selected from the detailed accounts of further researches on the "thermic foci," made with due precautions by application of numerous surface thermometers to the scalp. "With movements of the whole upper extremity (flexion and extension of the fingers and forearm and some rotation of the shoulders) a rise of temperature varying from 2·5° to 2·75° F. was caused over rather a large area, extending on the median line from a point 14 cm. behind the root of the nose, about 10 cm. back on the same line,

laterally about 9 cm. from the median line." This area was further subdivided as follows: prolonged and repeated contraction of the biceps caused a rise greatest near the median line, about 19 cm. from the root of the nose; by further approximation of the thermometers, an area of maximum rise was defined 3 cm. long, 5 cm. broad, near the median line from a point 17 cm. to one 20 cm. behind the nose. The area of rise caused by triceps exertion is placed behind the preceding area of biceps exertion, near the median line, 3·5 cm. long, and 6 cm. broad. That caused by flexion and extension of the wrist and fingers is placed at about the same distance from the nose as that of biceps exertion, but further from the median line; in the diagram its upper border considerably overlaps the lower border of the biceps and triceps area. This and other overlappings are attributed to oblique radiation of heat, and to insufficient limitation of muscular movement. The anterior part of the above area adjacent to the biceps area is assigned to flexors; the posterior part adjacent to the triceps area, is assigned to extensors of the fingers and wrist. General movements of the shoulder-joint and scapula caused a rise over a large area, anterior to the area for the arm, approaching near to the supraorbital ridge in front, extending laterally 8 to 9 cm. Of this thermal area, 5 cm. long, 4 to 5 cm. broad, extending from the biceps area to within 13 cm. of the nose, is attributed to the deltoid exertion. To the trapezius and levator anguli scapulæ is attributed an area extending along the median line, anterior to the deltoid area, to within 5 to 6 cm. of the nose, and being 6 to 6·5 cm. broad. By exercise of the pectoralis an area of increased temperature was obtained external to the preceding, opposite to a point on the median line 14 cm. from the nose, being 3 cm. long, 3 to 4 cm. broad. An area of equal size behind the preceding is allotted to the latissimus dorsi. Movements of the head and neck were found to cause rise of temperature over a considerable area in the lateral frontal region external to the shoulder region. General movements of the leg and thigh caused an elevation of temperature over an indefinite area lying behind that of the upper extremity. Flexion of the foot with extension of the toes gave a rise in an area (anterior tibial) 4 cm. long 5 cm. wide, lying next the median and posterior to the area of the triceps brachii. Contraction of the calf-muscles caused rise in an area behind the preceding 2·5 long by 5 cm. broad. "Contraction of the quadriceps extensor femoris developed the rather startling fact that activity of this muscle caused a rise of temperature over a

correspondingly large area of the posterior part of the head." It occupied a position next the median line of the head, extending from the posterior boundary of the calf area 30 cm. behind the nose, very nearly to the occipital protuberance, 38 cm. behind the nose, averaging 5 cm. in breadth. "Some rises in this area amounted to 2·75° F." Other areæ, external to the preceding, are distributed to flexors of the thigh, abdominal muscles, erector spinæ. The thermal areæ of facial and lingual muscles are individually defined in the lateral region of the skull external to the centres of the upper extremity, 8 to 10 cm. above the external auditory meatus.

In conclusion the writer draws attention to the striking correspondence between these thermal areæ on the scalp and Ferrier's psychomotor areæ of the cortex, and asks whether some of the elevations referred by Lombard to mental states are not largely due to muscular action. He adds to Ferrier's chart by locating psychomotor centres on the frontal or psychical lobes, and remarks with some justice that the usual routine examination of a patient is not likely to reveal losses of power limited to muscles like the trapezius, deltoid, pectoralis, &c.; only when these symptoms have been properly looked for and not found, the belief in destructive frontal lesions without paralysis will be legitimated.

A. WALLER.

Visceral Neurology—*Respiration.*—Some of the most interesting contributions to visceral neurology during the last six months have been made in the nervous mechanism of respiration. Langendorff of Königsberg has published several important observations with respect to the situation and relations of the so-called respiratory centre. In the first place he has confirmed the view of Longet, Volkmann, and Schiff, that the respiratory centre in the medulla is double, either centre corresponding with its own half of the body, inasmuch as longitudinal division of the medulla in the middle line does not interfere with the rate or regularity of the respiratory movements. A connection between the two centres must exist, however, for it is a familiar fact that, when both vagi are cut, the respiratory movements continue to be synchronous. Langendorff's new observation is that when this direct connection between the two centres has been severed by longitudinal incision, section of either vagus causes disturbance of the respiratory movements on the corresponding side only, the rhythm becoming, as

usual, slower; whilst simultaneous section of both vagi leads similar disturbance on both sides, the rhythm on the two sides of the chest being different in time and frequency. Irritation of the central end of the divided vagus of either side, either directly, or indirectly (*e. g.* through the trigeminus in the nose) leads to arrest of the movements of the diaphragm on the corresponding side only. It thus appears that either vagus is connected with the respiratory centre of its own side, and that this, again, innervates its own half of the diaphragm; and, further, that beyond the direct local connection between the two centres, the cause of the correspondence in the rhythm and force of their action is to be found in their relation to the vagi. (*Centralbl. f. d. med. Wiss.* 1879, p. 913.)

In a more recent paper (*ibidem*, 1880, p. 97) Langendorff gives an account of certain experiments which appear to prove the existence of "respiratory centres" in the spinal cord. Both after section of the cord below the medulla, and after ligature of the cranial arteries (in the rabbit), he observed whole series of complete respiratory movements. The previous administration of moderate doses of strychnia remarkably increased the distinctness of these movements, which were not only spontaneous for a time, but also induced reflexly by stimulation of different sensory nerves. Langendorff suggests in explanation of these results that the automatic respiratory centres are situated in the cord, and that the medulla exercises only the function of a regulating apparatus, the importance of which in normal respiration must not be underrated.

Whilst the limits of the "respiratory centre" have thus been extended downwards, Christiani announces (*ibidem*, 1880, p. 273) that he has discovered a respiratory centre of limited extent in the floor of the third ventricle and in the substance of the optic thalami, beside the corpora quadrigemina. Irritation of this spot, directly or indirectly, causes respiratory arrest in inspiration. This observation is of great interest in connection with that of Drs. Martin and Booker, which was recorded by us in Vol. I. of 'BRAIN,' p. 585.

The influence of the vagus on respiration has long been familiar to physiologists; and attention has more recently been directed to the character and origin of the impressions which are being constantly transmitted upwards through it to the respiratory centre. The *Selbsteurung* theory of Breuer,—that the conditions of dilatation and contraction of the lungs, at the end of inspiration and of

expiration respectively, are stimulants to the immediately following acts, that is, to expiration and inspiration respectively; and that the impressions of the conditions of distension and contraction are conveyed upwards by the vagus to the respiratory centre—has been steadily receiving support from recent observations. Langendorff (De Bois Reymond's *Archiv f. Anat. u. Physiol.* 1879, Supplement-Band, p. 48) has discovered that when artificial inflation of the lungs is carefully carried out in *non-narcotised* animals, expiration is induced; and that dilatation of the lungs acts therefore as an expiratory stimulant. The experimenters who previously failed to obtain this result operated on *chloralised* animals. That the movements following inflation of the lungs were not the result of simple elastic recoil was proved by the fact that they were arrested by section of the vagi. On the other hand, Gad of Würtzburg, experimenting differently, doubts the truth of Breuer's beautiful theory as far as it applies to the inspiratory effect of expiration, inasmuch as interruption of the vagus does not increase but diminish the length of the expiratory act. Whilst making these experiments, Gad succeeded in finding a *non-irritant* means of suddenly paralysing the vagus, and thus of avoiding the stimulant effects of section, which always follow for a short time and disturb the results. This non-irritant interruption he found in freezing, which appears to cause no irritant effect whatever. (*Ibidem*, 1880, i. and ii. p. 1.)

Von *Anrep* (Pflüger's *Archiv*, xxi. (1 and 2), p. 78, has shown that the vagus of the cat possesses its familiar influence on respiration from the time of the birth of the animal.

The Heart.—The author just referred to, in the same paper, confirms to a great extent the observation of Soltmann that in kittens a few hours old it is impossible to stop either the whole heart or any of its parts by irritation of the vagus with moderate currents. In the course of two to seven days powerful currents arrest the ventricles but not the auricles. After seven to fourteen days the inhibitory centres are in a condition to cause stand-still of the whole heart. During the first days of life section of the vagus in the same animal has no effect on the frequency of the heart; and atropine causes no acceleration.

Three of the most prominent symptoms of exophthalmic goitre, namely, cardiac excitement, exophthalmos, and swelling of the thyroid, have been produced together experimentally in the rabbit by Filehne (*Centralbl. f. d. med. Wiss.* 1880, p. 192). This result was obtained by section of the restiform bodies in their anterior

fourth, without injury of the under surface of the medulla. The vagi thereby lost their control of the heart; the eyes frequently became prominent; and the thyroid occasionally swelled. Only in a single case, however, did the three phenomena occur together.

The Uterus.—Röhrig, experimenting on rabbits, has located the uterine centre in the cord in the lumbar and lower dorsal region (*Centralbl. f. d. med. Wiss.* 1879, p. 668). He has also found that the uterine contractions which follow diminution of oxygen or excess of carbonic acid in the blood, are directly referable to the condition of the cord. Anæsthetics appear to reduce the excitability of the uterine centre in the cord, whilst strychnia, picrotoxine, nicotine, coffee, and ammonia excite the cord and the uterus. Ammonia alone acts upon the uterus if the cord be previously destroyed.

J. Mitchell Bruce.

Buzzard on certain points in Tabes Dorsalis.—Three lectures have appeared (*Lancet*, January 10, February 14, May 1, 1880).

In Lecture I., after sketching the anatomy of the spinal cord, attention is directed to the degenerative changes observed in a case of transverse myelitis from Pott's disease. These extend upwards in the form of fasciculated sclerosis in the posterior median columns, and downwards in the posterior portion of each lateral column. A condition pathologically similar forms the essential change in tabes dorsalis, where it occupies the posterior root zones. The secondary degenerations are explained by Türck by reference to Waller's law in regard to degenerations of nerve-trunks after section. Buzzard thinks that there is clinical evidence to show that the change in tabes is not seldom also a secondary affection, and that it commences in the connective tissue. Duchenne's definition of the disease is followed, but Romberg's term, "Tabes dorsalis," is preferred to "Progressive locomotor ataxia." In a typical case exhibited, two symptoms are demonstrated which are not included in Duchenne's definition—the *absence of patellar tendon reflex* and *inaction or sluggish action of the pupils to light, whilst they contract normally during accommodation.*

In Lecture II. attention is given to the *pains* which, contrary to the experience of some observers, Buzzard finds present in tabes with very rare exception indeed. Graphic descriptions by patients illustrating the characteristics of these pains are quoted in large numbers. As regards their frequency Buzzard has analysed a

collection of fifty-four cases of tabes occurring in his own practice, and in only one instance were the pains entirely absent. Erb's experience, which is quoted, goes the same way, and out of a total of 110 cases analysed by these observers, pain was absent in only 7 cases, so that, as far as these figures go, pain is a symptom which occurs in tabes in the proportion of nearly 94 per cent. of the cases. Buzzard pictures, as very characteristic of early tabes, a man going about his usual occupation with activity, and presenting no sign of ill-health, but liable to have, from time to time, paroxysms of horribly severe pains, *not usually limited to the district of one nerve, as in neuralgia*, but commonly attacking more than one locality. Hints for avoiding errors in regard to the examination of the patellar tendon reflex are given; and it is pointed out that it is the absence of this reflex, when the quadriceps extensor muscle is in a normal condition as regards response to electric currents and blows, which is the striking feature in Westphal's test. A patient was exhibited, in whom this reflex was discovered to be absent six months after the first symptoms of tabes. As regards the frequency of the symptom, out of 79 cases of tabes in which this point was tested (Erb and Buzzard), in 76 the patellar tendon reflex was absent. In two out of the three exceptions to this rule of absence there was no ataxia of gait. Buzzard relates a case which well illustrates the value of the symptom. To his mind it holds the same rank as an objective symptom of tabes as is occupied by the characteristic pains amongst the subjective symptoms of the disease. These two symptoms are the most constant of all, and they are probably the earliest. Buzzard believes that if a patient presents both, no other is needed to form a diagnosis of tabes dorsalis.

Lecture III. deals with the oculo-pupillary symptom first dwelt upon by Argyll Robertson, and recently investigated extensively by Ch. Vincent in Charcot's clinique. Out of 51 tabetic patients in only 4 the pupils reacted normally. In 7 there was complete immobility of the pupils (usually combined with amaurosis), and in 40 the pupils did not react, or reacted imperfectly, to light; but contracted during accommodation. Buzzard has devised a very convenient method of testing the pupils for this condition. The patient is directed to look over the observer's shoulder at a distant object. A strong light is then cast upon the eye with the ophthalmoscopic mirror, and the pupil watched through a convex lens of about No. 12 behind it. If the pupil does not contract, the patient is next told to look alternately at the distant object and at one

within ten inches or so of his eye. Uniform illumination should be maintained, and the diameter of the pupil watched as the gaze is shifted. B. suggests that a very interesting generalization is derivable from this symptom. It is, he points out, the *reflex* movement of the iris which is abolished or greatly affected in tabes—the *voluntary* movement, that which occurs during accommodation of the eye for near objects, is preserved. This is precisely analogous to what happens with regard to the patellar tendon reflex, and the circumstance lends, he thinks, additional support to Pierret's view, that tabes essentially attacks the sensory side of the cerebro-spinal nervous system—reflex movements being excited by impulses travelling along afferent (sensory) nerves.

Next comes an investigation of the pains in the head in tabes; and it is shown that these are very common, and that their occurrence is readily explained (as Pierret describes), by imagining a continuation upwards of the sclerosis of the posterior root-zones (the essential change in tabes) to the descending root of the fifth nerve, which in the lower portion of the medulla oblongata forms a crescent enclosing the gelatinous substance of the posterior horn. An original and very clear diagram shows why lightning pains should be expected to occur in the region of the occipital and trigeminal nerves. Buzzard suggests that certain cases of supposed obstinate neuralgia of the fifth may really depend upon sclerosis, which is limited perhaps to this root. He describes some important diagnostic differences between cranial neuralgia and these cephalic pains of tabes. A patient was shown who had applied on account of excruciating pains in the head. He was blind. The symptoms suggested intracranial tumour, but the patellar tendon reflex was absent, and investigation showed that the case was one of tabes with cephalic pains and sclerosal atrophy of the optic discs. Another, who had optic atrophy and the Argyll Robertson pupil, was reported to stagger occasionally, but had nothing else except absence of patellar tendon reflex. The lecturer referred to another he had seen in private, in whom the absence of the reflex was the only symptom in addition to optic atrophy. There could be no doubt, he thought, that these were cases of tabes dorsalis as yet in a restricted form.

J. HUGHLINGS-JACKSON.

Abstracts of the Gulstonian Lectures on Epilepsy. By W. R. GOWERS, M.D., F.R.C.P.

LECTURE I. The subject selected for the lectures was a study of the history of chronic idiopathic convulsive diseases, founded on a

numerical analysis of a series of cases which had been under the lecturer's care, chiefly at the National Hospital for the Paralysed and Epileptic. All cases had been excluded in which there was any reason to suspect organic brain disease, and all cases of simple hysterical fits without distinct loss of consciousness. The cases included consisted of epilepsy proper, epileptiform convulsions, not due to organic brain disease, and cases such as are commonly designated hystero-epilepsy, which present, with loss of consciousness, convulsive movements consisting of more or less co-ordinated spasm, but often combined with distinct epileptic symptoms. Care was taken however to distinguish as far as possible the degree in which the various conclusions applied to one or the other class. The hystero-epileptic cases constituted 18½ per cent. of the whole (185 cases out of 1000 on which an accurate opinion could be formed of the character of the attacks).

The first lecture was devoted to the subject of causation. Regarding the influence of sex, the proportion of 1450 cases was found to be 53·4 per cent. females, 46·6 per cent. males, or nearly as 6 to 5. The excess of females was smaller, though still marked (52 per cent.), in the cases of pure epilepsy taken separately. Of the hystero-epileptics, females constituted two-thirds. The investigation of heredity was directed to the existence of epilepsy, insanity, chorea, hysteria, and certain forms of paralysis—paraplegia and infantile paralysis. Hemiplegia was excluded as primary vascular. The cases of hysteria or paralysis in relatives were insignificant in numbers. Inheritance was traceable in 36 per cent. (452 of 1250 cases), and in the same proportion in the epileptics and in hystero-epileptics. Heredity influences sex; in the cases with inheritance the females were 5 per cent. more numerous than in those without inheritance. The heredity was on the father's side in 35 per cent., and from the mother's side in 39 per cent., from both in 5 per cent., and only brothers or sisters suffered in 15 per cent. The side of the inheritance influences the sex of the sufferers. The percentage of males affected was 22 per cent. greater when the disease was inherited from the father's side than when from the mother's. The reason why the females are in such excess in the inherited cases is because the inheritance is more frequently maternal, and then more girls suffer than boys. A family history of epilepsy was obtained in three-quarters of the inherited cases. In half (240 cases) it existed alone; in 54, combined with insanity. Insanity occurred in a third (157 cases), and existed alone in the majority. Chorea occurred in relatives of 35 cases.

The mother is herself less frequently diseased than the father: she is as frequently epileptic as the father, but is much less frequently insane. A case was related in which 14 members of the family suffered from epilepsy.

Phthisis has been supposed by some to predispose to epilepsy, and is certainly frequent in the family histories of epileptics, but others believe not more so than is explained by its commonness. Individual cases suggest an influence, but statistics scarcely support it. A history of phthisis, in some relative, was obtained in 39 per cent. only, of 300 cases. The proportion of phthisis is just the same in those with and those without neurotic heredity, and the percentage of neurotic heredity is nearly the same in those with and those without a history of phthisis. Signs of inherited syphilis were present in 8 cases of apparently idiopathic epilepsy, and in 6 of these the fits began after childhood.

The influence of age was ascertained from 1450 cases, and the percentage commencing in decennial periods was—under ten, 29; between ten and twenty, 46; between twenty and thirty, 15·7; between thirty and forty, 6; between forty and fifty, 2; and over fifty, 3; 12½ per cent. of the total commenced in the first three years of life, and 5¼ per cent. in the first year. The number, commencing per annum, fell to the sixth year, and then rose to a maximum in the sixteenth and seventeenth years, to fall rapidly after that age. The latest case was one which commenced at 71. Sex is influenced by age. In the cases commencing under ten years, the females exceeded the males by 6 per cent.; in those between ten and twenty, by 18 per cent.; between twenty and thirty, by 12 per cent. After this the relation is reversed. The males exceeded the females between thirty and forty years by 16 per cent.; between forty and fifty by 36 per cent.; between fifty and sixty by 40 per cent. Over fifty-five males only suffered. At each maximum period, both at infancy and puberty, the excess of females was very great.

The influence of heredity on age was ascertained from 1120 cases, and found to be much more uniform than current statements suggest. Of cases commencing under twenty (844 in number), 38 per cent. presented heredity. Of those between twenty and forty, 34 per cent.; and of those over forty, 27 per cent. The case which commenced at seventy-one presented heredity—his father having been epileptic. In the first twenty years of life the disease is hereditary in a larger proportion of females than of males; between thirty and forty, by more males than females.

How far do age and sex influence the occurrence of the hystero-epileptic or co-ordinated forms of convulsion? Of 1000 cases, this form constituted, in those commencing under ten, 15 per cent. of the male and 18 per cent. of the female cases. In those commencing between ten and twenty, it formed 14 per cent. of the male and 26 per cent. of the female cases. Between twenty and thirty the percentage of male hystero-epileptics is still 14, of females 21. Between thirty and forty the male cases fall to 12 per cent., the females rise to 26. In cases commencing over forty, this form is practically unknown in either sex. It is remarkable, however, that up to the fourth decade of life, one-third of the cases presenting hystero-epileptic phenomena occurred in males.

In considering the influence of *exciting* causes, the first point deserving attention is the cause of the large number of cases (180) which begin in the first three years of life. In one-third no causal information could be obtained. Of the remainder, in three quarters, the first fits occurred during dentition, and were referred to it. The percentage of neurotic heredity was 34, rather less than for the whole of life. If we ascribe to dentition convulsions the same proportion of the cases respecting which nothing was known, 7 per cent. of the whole become attributable to this cause. Teething convulsions are, however, well known to be usually associated with, and in large part the result of, the state of defective development which we call rickets, and the details of many of these cases supplied abundant confirmation of this. But in 27 other cases, which commenced after infancy, there had been severe dentition convulsions. If we attribute a predisposing influence to the early fits in these cases, we have a total of nearly 10 per cent. of the whole, in the causation of which rickets probably took part. This suggests that a considerable number of cases of epilepsy may be prevented by attention to the hygiene and diet of infants.

Excluding these cases, a probable exciting cause was ascertained in 438 out of 1150 cases, or 37 per cent., and was described in males (44 per cent.) more frequently than in females (31 per cent.), and the smaller proportion in the latter was chiefly due to the large proportion of cases in women between ten and forty years for which no exciting cause could be traced. In males the proportion presented but little variation in the different periods, increasing, however, late in life.

Of the cases presenting an exciting cause, more than a third (157 cases) were attributed to psychical influences, and of these fright caused no less than 119. It is effective chiefly in early life

—only 3 commenced after thirty, and 100 commenced under twenty. The age at which the two sexes suffered accords with their known emotionality—they were affected equally under ten. The males were to the females between ten and thirty as 3 to 4; between twenty and thirty, as 3 to 13; and over thirty, the only cases were in women. The influence of this cause is readily intelligible when the motor and visceral disturbance which alarm causes is considered. In one-third the first fit occurred immediately after the fright, in the others an interval elapsed. Two-thirds of the cases due to this cause were epileptic, one-third hystero-epileptic. The form of the fits is influenced by the interval after the fright—the shorter this is, the larger the proportion of cases of hystero-epilepsy. Other forms of mental excitement caused the first fit in 19 cases. Anxiety was the cause in 29 cases, in which males preponderated.

Sixty-five cases were apparently excited by blows and falls on the head. This cause affects the sexes equally under ten, but females after this date in gradually decreasing numbers. In two-thirds of the cases the injury was a fall, in one-third a blow. In one-fifth the first fit occurred instantly, in the others an interval elapsed. Exposure to the sun was the alleged cause in a considerable number of cases, and seemed probable in 27—20 males and 7 females. The males were distributed equally through life, most of the female cases commenced in childhood. The form of convulsion was almost always pure epilepsy. In 10 there was a distinct attack of sunstroke.

An acute disease was the cause of the first fit in 37 cases, 14 males and 23 females. In 9 it was measles, and in 19 scarlet fever. In many of the latter cases there was no dropsy or ear-disease; the first fit occurred during the height of the fever, or during convalescence, and was apparently due to the effect of the scarlet fever poison on the nerve-centres. In 9 cases the first fit was after immersion in the water, in 6 it was ascribed to digestive derangement, and in 6 to intestinal worms, the attacks continuing after the worms had been expelled. Chronic alcoholism caused 13 cases. Six patients were the subjects of chronic lead-poisoning. In 2 of these there was renal disease, in 1 fits, existing before, were intensified by the plumbism, in the remaining 3 the cases appeared to be saturnine epilepsy, chronic, resembling ordinary epilepsy. In 2 other cases chronic renal disease was the only discoverable cause of chronic epileptiform convulsions, without other signs of uræmia. Both lead and renal disease occasionally cause mental derangement. One case was apparently due to working in a tobacco factory; one commenced after the inhalation of chloroform, and in one,

attacks which had ceased for many years, recommenced after the inhalation of nitrous oxide.

Of sexual processes, retarded or absent menstruation coincided with the first fit in a large number of cases, in girls at puberty, but the causal relation between the two was difficult to ascertain. Masturbation is frequent in epileptic boys, but was certainly the cause of the fits in only a few cases.

The heart was not examined in all cases, but in 93 abnormality was found; frequency of action in 8, irregularity in 9, reduplication of the first sound in 13 (all young). In 30 cases there was valvular disease; mitral regurgitation in 20, mitral constriction in 7, aortic regurgitation in 3, aortic constriction in 1. There was dilatation only in 20, and hypertrophy only without renal disease in 2. In some cases the association with epilepsy seemed accidental; in some others the cardiac disturbance may have been due to the strain during the fits; in others the heart-disease had preceded the epilepsy, and may have been one of its causes.

In 20 cases of epilepsy the patients had also had chorea. In 8 the epilepsy existed first; in 12 the chorea preceded the epilepsy, in 4 immediately, in 5 at an interval of years. It seems probable that the disturbance of the motor centres during chorea may predispose to epilepsy.

Lecture II. Of the symptoms of the series of cases which formed the subjects of the lectures, the first point examined was time at which attacks occurred. Of 840 cases the fits occurred at night in one-fifth, in the day in rather more than two-fifths, and both night and day in rather less than two-fifths. In 5 per cent. they occurred only in the early mornings. There was no difference in these respects between the cases of pure epilepsy, and those with hystero-epileptic symptoms. An equal proportion occurred by night. The *first* fit occurred in epileptics rather more frequently by day than by night, in hystero-epileptics much more frequently by day. When the first fit occurred in the day, the subsequent fits occurred only in the day in half the cases; only in the night in one-seventh, both night and day in one-third. When the first fit occurred during the night, the subsequent fits occurred only at night in about two-fifths of the cases, both day and night also in about two-fifths, by night only in one-sixth. If fits which have recurred at night only, commence to occur in the day, they commonly continue at night. If they have existed only by day, and occur at night, they commonly cease by day. If they have

occurred both day and night, they often cease to occur in the day and continue at night, but very rarely cease at night and continue by day.

Of 82 cases in menstruating women, in one-twelfth no attacks occurred at the time of menstruation; in more than half they were worse at those periods, commonly before, or during, menstruation, rarely after.

Of the symptoms of the attacks, that selected for detailed analysis was their modes of onset. "Auræ" and "warnings" are now known to be the effect on the consciousness of the commencing change in the brain, and so give important information regarding the region of the brain on which the process of the fit begins. This mode of investigation was initiated by Dr. Hughlings-Jackson. The "discharge" may begin in an intellectual, motor, or sensory centre, and the distinction of the two latter is of great importance in their study.

Of 1000 cases, warnings were present in the attacks of 505, and the results of the analysis of the latter were described at length. The auræ may be referred to almost any part of the organism, but were divided, for clinical convenience, into seven groups.

(1.) Unilateral peripheral auræ (86 cases) were referred to one side of the tongue (7), face (17), arm (45), leg (15), and trunk (2 cases). No cases of presumably organic disease were included. The commencement on the tongue was less frequently by a movement than by a sensation. The normal associations of function were reproduced in certain combinations of the aura, viz., with movement in the lips and jaw, and with nausea. All cases commencing on the tongue were right-sided, which suggests (as does its frequent paralysis in aphasia), that its representation is chiefly on the left side of the brain. The attacks commenced in the face as frequently on one side as on the other, but much more frequently by a motion than by a sensation.

Commencement in the arm, when by movement (in eighteen cases) was almost always in the hand as a whole or arm as a whole; when by sensation (in fourteen cases) it was commonly in a definite part of the hand, and never higher than the wrist. In five other cases the sensation was probably motor: a sense of movement without movement. The attacks beginning by movement, or a motor sensation, commenced in one arm as often as in the other; those beginning by sensation began in the left hand twice as frequently as in the right. In cases of progress before loss of consciousness, the course was to the head, or down the side to the leg.

Commencement in the leg was by a movement (in five cases), usually in the foot, once in the hip; or by a sensation (five times), usually in a definite part of the foot. When the aura progressed before loss of consciousness, it passed up the side to the head, or down the arm. In these limb auræ there are two ways in which the second limb is affected, one by passage by continuity, up or down the trunk, and down the second limb; the other by fresh commencement in the extremity of the second limb, and passage of the aura up both. There is reason to believe that when the passage is by continuity through the trunk, the discharge in the sensory centre leads, and a case was related in which a sensory aura had this course, and motion was only added when it had gone down the second limb, *up* which the *spasm* passed. Special sense auræ were never associated with tongue, face, or leg auræ; and with an arm aura only when it began with sensation. The known relations of the cortical centres in the brain afford only a little help in explaining the progress of auræ; probably because this is largely influenced by the position of the undefined sensory centres for the limbs, in which many discharges seem to begin. Of the fits commencing unilaterally, 88 per cent. were purely epileptic, 12 per cent. presented hystero-epileptic symptoms.

In the second group were placed certain general auræ, bilateral sensations in the limbs, tremors, starts, malaise, &c. The commencement was in both arms in 11 (almost all purely epileptic), in the legs in 12 cases (3 certainly and 4 probably hystero-epileptic). Trunk auræ, not visceral, were rare, and were referred to the spine: the attacks were all purely epileptic. So also were the attacks commencing by general tremor (13 cases), and starts or jerkings (10 cases). Malaise constituted the warning in 15 cases, and faintness that of 13 cases; and of the attacks preceded by these general *sensations* about one-half were hystero-epileptic.

The third group comprehends auræ referred to certain viscera, mainly those to which the pneumo-gastric nerve is distributed; the epigastric sensations, choking, dyspnœa, nausea, and cardiac sensations. These were present in 106 cases. The epigastric aura (51 cases) consisted of actual pain in a third; it was sometimes referred to the left hypochondrium, but never to the right. When pain, it remained at the epigastrium until consciousness was lost. When a vague sensation, it often passed up to the head, or to the throat as choking. The latter sensation seems to be the same as the globus hystericus, and may be described in identical terms, even in organic disease. The warning was simply "choking,"

referred to the throat in eighteen cases, and dyspnœa or suffocation in six cases. These ascending auræ seem referable to the respiratory function of the vagus; the epigastric *pain* seems connected with the gastric functions, for in many cases nausea, and in some retching, was associated. Cardiac sensations constituted the warning in 16 cases; pain in 2, a vague sensation in 3, and palpitation in 11. Hystero-epileptic cases constituted one-fifth of those with an epigastric aura, or with chest dyspnœa, one half of those with a throat aura, and one-third of those with a cardiac aura.

The fourth group comprehends the auræ which consist in the fact of rotation, or the sense of giddiness, described as no less than 90 cases. Most were epileptic, one-sixth only being hystero-epileptic. In most, consciousness was very early lost.

Sensations referred to the head (fifth group) preceded the fits in 50 cases; vague in 29; pain in 21. In one-fourth of these cases the attacks were hystero-epileptic, and the proportion was nearly the same, whether the warning was a vague sensation or actual pain. Sudden somnolence was the warning in 5, and sudden inability to speak, in 9 cases.

A psychical aura (sixth group) was described in 25 cases; an emotion in 10; an idea in 15. The emotion was always fear, but bore no relation to fright as a cause. Associations with other auræ were rare; and in no case was it combined with an epigastric sensation. Only cases were reckoned in which the emotion was mentioned spontaneously by the patient, since, in most cases, with a deliberate aura, some alarm is felt. All the cases were purely epileptic. The intellectual aura was commonly a vague idea. Several patients described sudden recollection of many past events. A sudden sense of strangeness was felt in a few cases.

The last group consists of the auræ referred to the special senses (119 cases). An olfactory sensation, usually unpleasant, was noted in 7 cases, all purely epileptic, a gustatory sensation, described as a taste between sour and bitter, in one case only. In 84 cases, the warning was referred to the organ of vision. It was a sensation in the eyeball in 7; diplopia in 5. In a few there was an apparent magnification or diminution in the size of objects, probably connected with a commencing discharge, or inhibition, of the visual centre. Loss of sight preceded loss of consciousness in 26 cases (4 hystero-epileptic). In 46 cases the aura was a visual sensation (35 certainly purely epileptic). In 17, colours were seen, which could be described in 15. Red and blue were the only colours seen alone; one of them was always mentioned, and both

were present in half the cases. The order of frequency of colours was red (11), blue (8), green (3), yellow (3), purple (1). This order does not correspond with the order in the spectrum, nor with the size of the fields of vision, but it does with the visibility, of colours in direct sunlight according to Cohn, which is red, blue and green equal, yellow, violet. In 14 cases the aura was a highly specialized sensation, a visual idea, which in one case succeeded, in another coincided with, a simpler visual sensation; in the others, came alone and first, and must have been due, not to "loss of control" but to the discharge. Associated auræ were rare, but one instructive case was related at length; an epigastric sensation ascended through the chest as beating, and then was heard as knocking. This was followed by hissing, then by the vision of an old woman holding out a strongly smelling substance, then by two lights; lastly a sense of choking immediately preceded loss of consciousness. The only anatomical fact recorded regarding these auræ was a case, published by the lecturer, in which attacks preceded by a flash of light and micropsy were due to a tumour behind the angular gyrus.

Auditory warnings existed in 27 cases; sudden loss of hearing in 6; an auditory sensation in 21; a loud sensation of low specialisation, "crash," "blow," "hissing," &c., in 12; in others an "auditory idea." In several cases auditory and visual sensations were associated, and in some they were alike in character, *i.e.* in degree of specialisation. An unpublished case was mentioned, which the lecturer had watched with Dr. Hughlings-Jackson, in which attacks preceded by an auditory sensation referred to one ear were due to a tumour which had commenced in the white substance of the opposite temporo-sphenoidal lobe, within the convolution in which Ferrier places the auditory centre.

Of the other symptoms of attacks, time permitted mention of only one or two. Pallor of face is, it was urged, much less frequent than current statements suggest, and in both major and minor attacks may be entirely absent. The tonic and clonic spasm are continuous; the interruptions may be felt by the hand before they are visible to the eye. Slight attacks may consist of either clonic or tonic spasm: when the latter only, the attack is allied to hystero-epilepsy. The hands in an epileptic fit are not often clenched; more often they are in an interosseal position, the wrists flexed, the fingers flexed at the metacarpo-phalangeal, extended at the other points; the thumb bent in: an exaggeration of the position seen in tetany.

Some forms of hystero-epileptic attacks seen in this country were then described: Their characteristic is *co-ordinated* spasm, movements of quasi-purposive character. They have alliances with epilepsy and insanity as well as with hysteria in its simpler forms. In the first variety, resembling most that described by Charcot, the patient suddenly falls, and passes into a condition in which tonic spasm, often with outspread arms, alternates with violent movements, opisthotonos, wild movements of the limbs, &c. There is often internal strabismus, and frequently manifestations of intense terror. When severe, this frenzy and violence might be described as compressed mania. Sometimes there is a curious theiro-mimicry, and the patients will bark, and will bite in a strangely animal manner. In women ovarian tenderness sometimes exists, but the lecturer had never known ovarian pressure in the natives of this country succeed in bringing on these attacks, and, although it will sometimes arrest them, cutaneous faradisation does so more readily. Such attacks occur most commonly in girls and women, but also in boys and occasionally in adult men. A second variety is characterised by violent emprosthotonos, a third by curious rhythmical movements of flexion and extension of the legs, and a fourth by intense dyspnœa, reaching almost the point of suffocation. An instance of the latter, a somewhat rare form, was narrated at length.

Lecture III. The third lecture was devoted to pathology and treatment. In idiopathic epilepsy the facts of pathological anatomy are of most doubtful value. The problem of pathology resolves itself, in the main, into four questions: What is the seat of the "discharge" which causes the symptoms of the fit? Is the seat of the discharge the seat of the disease? How far does such "discharge" explain all the symptoms of the fit? What is the ultimate nature of the morbid state which causes the discharge? The word discharge was used, without theory, to signify the sudden liberation of nerve-force.

With regard to the first question, the seat of the discharge, there are two classes of facts. (1) There is a "convulsive centre" in the medulla, capable of giving rise by its action to general convulsions (Nothnagel). (2) Of all regional diseases, lesions of the cortex stand incomparably first as a cause of convulsion, and experiment demonstrates that convulsions may be produced by irritation of the motor region of the convolutions. But even the second set of facts alone scarcely warrant the conclusion that epilepsy is a cortical disease, because deeper motor structures, excitable from

the surface (Burdon-Sanderson), may be the parts which discharge primarily in convulsions, quite similar to those produced by experimental irritation. The affection of consciousness does not prove that the discharge begins in the highest centres, since discharges in lower centres may affect the centres above them as well as those below (Robertson), and in current theory an explanation of loss of consciousness is found in vaso-motor spasm. Thus neither pathology nor experiment enables us to exclude the lower centres, and the latest writer of a systematic account of the disease, Nothnagel, finds no reason to doubt that epilepsy is primarily a disease of the convulsive centre in the medulla oblongata.

The clinical study of modes of onset, however, gives us further help. In the cases (no inconsiderable number) in which the warning is a special sense aura, or psychical aura, we must conclude that the process of the fit begins in the special sense and intellectual centres, within the hemispheres. Thus the teaching of pathology is right in its indications, and we must conclude that in many fits the discharge commences in the cerebral hemispheres. If so, what facts are there to indicate that in epilepsy the fits ever do commence in the medulla? Such facts are, it must be confessed, scanty. The pneumogastric auræ, i. e., the visceral auræ referable to the respiratory and gastric centres, might be regarded as evidence that the convulsions depend on discharges in the medulla. But these centres are certainly (as Dr. Hughlings-Jackson has insisted) represented in the hemispheres; they are readily affected in emotional disturbance; and facts mentioned in the last lecture show that they may be easily disturbed in discharges unquestionably originating in the hemispheres. But we must not conclude, from the absence of direct evidence, that no fits commence in the medulla, and in a curious case under the care of Dr. Ramskill, the symptoms suggested this seat, for there was general powerlessness, and the attacks could be at any time brought on by passive movements of the trunk. The wide extent and varied character of the initial symptoms of fits points (as Dr. Hughlings-Jackson has urged) to their probable origin in any grey matter in which sensori-motor processes occur, but the evidence that they originate in the hemispheres is much more frequent and much stronger than that they commence lower down.

The question whether the seat of the discharge is the seat of the disease may be considered together with the third question, does the discharge which causes the convulsion explain all the symptoms of the attack? According to current theories vaso-motor

spasm is the cause of loss of consciousness, and some have added, of the motor discharge itself. But vaso-motor spasm is not *necessary* to explain the loss of consciousness, since the "discharge," as we have seen, may produce it. On what direct evidence has the vaso-motor theory been based? Mainly on the facts that there is pallor of the face in an epileptic fit, and that cerebral anæmia will cause convulsions. But, it was urged in the previous lecture, that pallor of face is often absent. Moreover we cannot infer from the state of surface-vessels the state of deeper vessels. Pallor of face, when it occurs, may be the effect of the cerebral discharge, not an indication of its cause. Between the fact that anæmia of brain will cause convulsions, and that vaso-motor spasm is the cause of any of the phenomena of epilepsy is an unbridged gulf, which is widened by every increase in our knowledge of the clinical history of the disease. Dr. Hughlings-Jackson's theory, that local vaso-motor spasm results from the commencing discharge and determines its spread, seems unneeded and opposed to the fact that functional activity of organs (and of the brain, Ferrier) causes dilatation of their vessels. Thus it is urged that all the phenomena of epilepsy may be explained by the instability of grey matter, and that there is no warrant or need to go farther in explaining. Epilepsy is thus regarded as without any uniform seat: as a disease of tissue.

What is the probable nature of the tissue-change? The "over-action" has been regarded as the indication of an increased functional and therefore nutritive activity (Hughlings-Jackson), or as really due to a general impairment of functional power and under-nutrition (especially by Dr. Radcliffe). Modern physiology seems to indicate the direction in which an answer is to be sought. The notion that there must be a resistance to action in nerve-cells, opposing the tendency to liberate energy, has underlain such expressions as "nerve tension," but has only lately been formulated, and promises to give clearer views of many physiological problems, and, as Dr. Ringer has shown, of many pathological problems also. The amount of latent energy in the brain, held in check, may be infinitely greater than any manifestations of it would suggest. The phenomena of epilepsy better accord with the notion of an instability of resistance than an excess of the energy-producing function. Thus the convulsions from loss of blood may be best explained, and so also may the arrest of a commencing fit by a peripheral impression. Once arrested (by raising resistance), it does not recur, as it would if dependent on primary overaction.

The internal resistance is probably a higher function than the transformation of force, and so an apparent over-action, an excessive liberation of energy, may be the result of imperfect nutrition.

The phenomena of hystero-epilepsy are, it was suggested, due to an instability and discharge of grey matter of different position and perhaps character. When succeeding an attack of epilepsy, major or minor, they have been regarded by Dr. Hughlings-Jackson as due merely to loss of control by the discharge of higher centres, on the ground that actual discharge can only itself cause incoordinate "brutal" effects. But the co-ordinated spasm of a hystero-epileptic fit *may* commence in the first movement of the fit; and the discharge of epilepsy sometimes, as in cases mentioned in the last lecture, may cause special-sense or intellectual symptoms of very high specialisation. In cases in which co-ordinated convulsion succeeds an epileptic fit, the hypothesis of loss of control seems scarcely adequate. It may be one element, but an instability of the lower centre seems essential; for why should attacks apparently quite similar be never followed by these symptoms? Automatic action commonly succeeds epilepsy, but, it was urged, may, in rare cases, occur without preceding epileptic symptoms. It was suggested, therefore, that all co-ordinated and automatic phenomena, often succeeding epileptic symptoms, may sometimes occur alone. In some cases they may be due only to loss of control, but they have commonly an anatomical basis in lessened stability of the centres on which they depend; that all *may* be due to a primary discharge of the unstable centre, but that the frequency with which they occur alone lessens as we ascend the scale of complexity. Automatic action is much rarer without preceding epileptic symptoms than are the "co-ordinated convulsions."

The clonic spasm of the later stage of an epileptic fit is continuous with the earlier tonic spasm, and may be due to the venous congestion, not exciting it, but interrupting and arresting the previous tonic spasm. Local slight epileptiform seizures commonly consist of clonic spasm only, and, as the discharge spreads and becomes intense, the spasm becomes tonic. The two are thus rather variations of the same form, than of different kind.

The treatment of epilepsy, it was remarked, is a subject on which numerical analysis gives little help, because so many patients, whose fits come under treatment, relapse when treatment is relinquished. The time available permitted little more than a statement of the remedies most useful in 562 cases, in which the effect of treatment was carefully noted. The results showed that,

while we must not rely *exclusively* on bromides, on these our chief trust must still be placed. The value and method of use of bromides, alone and in combination, of belladonna, digitalis, opium, Indian hemp, picrotoxin, &c., and the occasional value of borax, were then alluded to. After referring to the treatment of hystero-epilepsy, especially by apomorphia, the lecturer remarked, in conclusion, that although the condition of many epileptics was still gloomy enough, yet the present generation had witnessed an advance in the treatment of the disease equalled in, perhaps, no other branch of therapeutics. Thanks to the influence of one drug, the use of which in epilepsy was due wholly to Fellows of that College, hundreds of sufferers had been cured, and thousands were leading useful lives who would otherwise have been incapacitated by the disease. For all the victims of the disease, we might surely trust that the progress of the recent past is the dawn of a brighter day.

W. R. G.

On the Disease called Sturdy in Sheep, in its Relation to Cerebral Localisation.—In the January number of the *Journal of Anatomy and Physiology* I published an article with the above title, and in the present communication I propose to give a brief summary of those points on which I dwelt at some length in that paper. But to render my remarks clearer, it will be necessary that I first sketch in outline the disease called Sturdy, which is so named from its prominent symptom being a rotatory movement of a very peculiar character. It is common among sheep wherever they are herded together and tended by dogs, the latter point being of special importance, for the disease consists in the presence in the brain of the sheep of an hydatid, the cænurus cerebralis, which is a cystic or bladder-worm, and is the larval stage of the tænia cænurus, one of the six varieties of tape-worm infesting the dog.

This fact having been conclusively shown by Kuchenmeister, it is not difficult to trace the course of events in the case of a sheep-dog afflicted with tape-worm. He wanders about, distributing the ova of the tænia on the pastures, where they are swallowed by the sheep while grazing. When they have reached the animal's stomach, they are acted on by the gastric juice, their hard coverings are dissolved, and the small six-hooked embryos escape. By means of their hooks they bore their way into the blood-vessels and are carried to the brain, where they take up their abode, either from their having some predilection for that

organ, or because the peculiar cerebral circulation of the sheep, with its wonderful *rete mirabile*, favours their doing so. Having reached the brain, they make their way out of the blood-vessels, part with their hooks, and gradually acquire the bladder-worm state, varying in size from a pin's head to a walnut. After a time they assume the polycephalous condition, and an hydatid in this stage of development consists of a thin transparent bag or membrane, containing a clear fluid, and having a number of small whitish spots like eggs on its surface, disposed in regular lines. These are the heads of the hydatid, and I wish to direct special attention to the fact that they are *exsertile* or *protrusible*, a characteristic of some importance. An hydatid cyst of this nature may attain any size, but is not actually incorporated with the brain substance, being surrounded with areolar tissue. One other point connected with the history of this hydatid demands notice. It is this: that after a variable time it causes softening of the skull in its vicinity, the bony roof of the cranium disappearing both by reason of the pressure, and also probably from the protrusible heads of the hydatids not only removing the brain substance but also eating away the bone itself. This soft and yielding spot forms a guide to the situation of the hydatid.

Passing next to the symptoms which this malady gives rise to, we find that they of course vary with the stage which it has reached. Its earliest indications are those of cerebral congestion, as shown by redness of the eyes and dilatation of the pupils, together with a desire on the part of the animal affected to separate itself from the rest of the flock. It is also dull and listless in its movements, and in its desire for food. Any temporary improvement in these symptoms is soon followed by signs of increased nervous irritation, the creature being easily and groundlessly alarmed, and delighting to stand over running water, as if the murmuring sound caused by it had some soothing influence over it. In addition, there is difficulty in grazing, the head often turning to one side, to be soon followed by the rotatory movement which is characteristic of the disease. When once this is developed it goes on increasing in frequency to such an extent that the animal is unable to feed; and though eventually the movement may diminish in intensity, or even cease altogether, the creature becomes so exhausted and emaciated that at last it dies, unless operative interference should be undertaken for the removal of the cyst; but even this, as usually performed, is a somewhat fatal operation, owing to the admission of septic air, which sets up

putrefaction in the contents of the cyst, leading to inflammation and death. Such was the course of events in the first case of sturdy that came under my notice; and I fancy, from what I can learn, it is the chief cause of mortality in the cases submitted to operation.

Space does not allow me to go into the discussion of any of the individual cases of sturdy in their bearing on the theory of localisation of brain function, although some of them presented points of considerable interest. I must content myself with remarking only on one or two other points which the disease brings out, and chief among these is the cause of the rotatory movements which are so characteristic of the malady, and which also occur, as is well known, in animals that have been experimented on. In this latter case they are seen after very different operations, and Brown-Séquard has tabulated a number of the injuries that cause them, showing they are confined to no particular structure. This fact is also borne out by the disease of sturdy, for they declare themselves in that affection irrespective of the structure involved. Some explain them by the theory that they are due to spasms and paralysis of the muscles on the side towards which the movement takes place, and more recently in a clinical lecture, published in the *Lancet*, December 13, 1879, I find that Dr. Broadbent attributes their occurrence in animals to the association of the nerve-nuclei of the fore and hind limbs in connection with their mode of progression. But from my own observations in the cases of sturdy which I have seen, I am inclined to regard these movements as having another origin. I look upon them as caused by the presence of the hydatid itself in the brain, which so acts as a cerebral irritant that it sets up manifestations of nervous energy, interferes with the proper working of the general co-ordinating mechanism of the brain, and disturbs the delicate and sensitive apparatus of the nervous system. As a result of this, inhibitory influences are brought into play, which act on the will and also on the different senses, which are not only affected, but it may be thrown into abeyance. Now we know how completely this body of ours depends for its daily activity and movements on the integrity and healthy working of the channels through which travel the various impulses that invade our frame. No better illustration of this can be given than the extent to which ordinary locomotion depends on the integrity of sight. As Mayo long since put it, "we lean on our eyesight as on crutches." These remarks apply with equal if not greater force to animals, for we are aware that Longet and Flourens produced vertiginous movements in

pigeons by blinding or evacuating the humours of the eye. Struck by the fact that, as far as I had seen, the rotatory movement was always to the side on which the cyst was, I was led to look carefully into the state of vision, and I invariably found that when there was present this rotatory movement, there was impairment of sight on the opposite side of the body.

The conclusion then that I was led to draw was that while the presence of the hydatid in the brain sets in action nervous force, which the weakened will of the animal is unable to control, the *direction* of the movements is determined by the side on which vision is impaired. There seems to me further confirmation of this in the fact that when the disease becomes far advanced, and the sight in both eyes is affected, as is sometimes the case, the vertiginous movements cease. Upon these grounds this disease seems to me valuable, inasmuch as it affords us an explanation of the cause of the so-called "circus" movements seen after experimental operations, and also furnishes us with a clue as to the influences which determine the *direction* of these movements.

Lastly, I would direct attention to the following fact, to which I have already incidentally alluded, that the feasibility of removing the cyst must not be lost sight of. Apart from the procedure affording a good means of testing the value of antiseptic and non-antiseptic methods of treating wounds of the cranium, to the physiologist it would be still more valuable, for it would allow of his operating at definite stages of the disease, or whenever particular symptoms supervened. He might thus ascertain exactly the lesion present, and whether the symptoms observed were temporary or permanent. The only precautions necessary would be to wait until the softening of the skull gave some indications of the situation of the cyst, and to perform the operation with antiseptic precautions (Lister's method), so as to reduce to a minimum the chance of any subsequent putridity and inflammation, which might interfere with the observations made. In support of this suggestion I would only briefly allude to one case in which I removed the cyst by operative interference. In that case one of the chief symptoms was loss of vision in both eyes, but the animal was dull and lethargic to a degree, and reminded one of a creature deprived of its cerebral hemispheres. In a few days after operation it recovered its sight, and was restored to its usual health and habits of life, so that one could not have told that there had been anything wrong with it. When it was killed, some weeks after, I found that the cyst had occupied a place in the brain closely approximating

to Ferrier's centre for sight. Now had I not operated on it I should have regarded it as a case in which the visual centre had been destroyed, but the complete return of that sense after operation indicated that it was really only in abeyance. In other words, the organ of sight was temporarily involved, owing to the disturbance set up in the mechanism of the brain by the presence of such an irritant as we have seen that this hydatid is. This return of a function that seemed destroyed as soon as the source of irritation was removed, is only another instance of how careful we should be in drawing conclusions from experimental inquiries, a caution fully borne out by Goltz's numerous physiological experiments.

GEORGE T. BEATSON, B.A (Cantab.), M.D. (Edin.).

Tripier on Anæsthesia from Cortical Lesions. (*Revue mensuelle*, January and February 1880.)—In this memoir M. Tripier reviews the various explanations which have been given of the paretic or paralytic symptoms resulting from cortical lesions, and gives the details of some recent experiments he has made (in four dogs and one monkey), as well as several clinical cases in support of the thesis, that lesions strictly cortical cause not only motor symptoms but also defect of sensibility, principally, but not exclusively, tactile.

In his previous experiments, in which he had shown that dogs never really recover entirely from cortical lesions, and that the defect in mobility could always be reproduced by morphia, he had failed to detect any deficiency in sensation; but in the experiments here recorded, made with the special object of testing the sensibility, he finds that after lesion of the sigmoid gyrus, there is not merely paresis of the limbs, but also deficient reaction to cutaneous stimuli—pricking with a pin—on the affected side. This is most marked in the face and paw, but is more or less general, and may be observed immediately after the lesion, or even up to nine months afterwards.

He concludes from this that the sensibility is blunted or deficient.

He, however, opposes the views of Schiff, &c., that the defect in mobility is dependent on the deficient sensibility, and gives experimental evidence of the fact that division of the sensory nerves of the limb does not cause such motor disorders as result from cortical lesions. The motor symptoms are therefore the direct effect of the cortical lesions, but these are also combined with defect in sensibility, though the two are independent of each other.

The clinical cases adduced are cases of hemiplegia combined with hemianæsthesia, of greater or less degree, in which no other lesion was discernible post-mortem than cortical lesion, the ganglia and internal capsule being to all appearance intact. He is of opinion that there is no special sensory region in the cortex, but that the lesions which mainly cause hemiplegia (fronto-parietal), also cause hemianæsthesia. The latter, however, is more transient.

[M. Tripier's argumentation is not very conclusive. His clinical facts prove nothing. He might have cited cases with similar symptoms without discernible lesion in the cortex or elsewhere. It has been indisputably proved, in opposition to M. Tripier's views, that we may have most complete motor paralysis from cortical lesions, with full retention of sensibility both to tactile and painful stimuli.

Assuming the complete accuracy of M. Tripier's experimental data, they prove nothing beyond deficient reaction to stimuli. That this deficiency is on the sensory side is an inference which is not admissible until a clear discrimination can be made between psycho-motor and mere reflex reaction. Such a standard M. Tripier has not supplied, and to do so is no easy matter. An animal may not react to a cutaneous stimulus, not because it does not feel it, but because its volitional power is impaired. Even as M. Tripier's own data show, the reaction to a painful stimulus, such as would normally excite reflex movements, is as distinct on the one side as the other.]

Sommer on Diseases of the Cornu Ammonis (*Archiv für Psychiatrie.* Bd. x. Heft 3).—Sommer tabulates 90 cases, collected from various sources, in which the hippocampus was affected along with other cerebral regions, from which it is clear that epilepsy is frequently associated with degeneration in this region and its neighbourhood. He estimates the proportion at 30 per cent.

The lesions are divided into two principal forms: 1, the classic form, described first by Meynert, in which there is atrophy and sclerosis in one or both cornua; and 2, lesions of various kinds, such as softening, softening with redness, redness and punctiform hæmorrhages, pressure, &c. The proportions in which the various affections occur are stated in a tabular form. A detailed description is given of the microscopical characters of the degeneration which occurs.

Affections of the hippocampus in epileptics are associated in a

large number of cases with excentric sensory disturbances, indicating that the sensory centre is here, or in close relation with it.

Of the 90 cases analysed, 38 had sensory disturbances in the form of hyperæsthesia, paræsthesia, and anæsthesia.

Of the 52 negative cases, the records are either incomplete, or the conditions were such as to preclude any observations on this point.

Of the 38 positive cases, 27 relate to affections of common sensation; anæsthesia 7 times, hyperæsthesia 3 times, paræsthesia (formication, &c.), and actual hallucinations 15 times, and lastly 2 in which, owing to the mental condition, it could only be inferred. Frequently the common sensory disturbances were associated with illusions of hearing and sight, less frequently of smell and taste. Occasionally, however, these latter were alone affected without implication of common sensation.

Our author regards it as beyond doubt that there is a direct relation between degeneration of the hippocampus and the disturbance of common sensibility.

He next proceeds to the consideration of the experimental, anatomical, and other clinical evidence in favour of the view that the hippocampus is the centre of common sensation.

The first is furnished by Ferrier's experiments, which are briefly analysed.

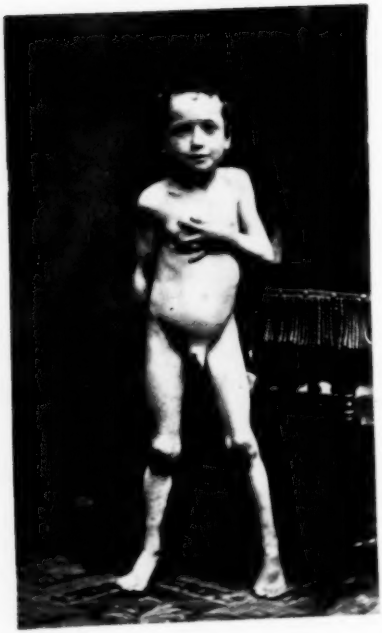
The anatomical evidence is as yet incomplete. He refers to the researches of Meynert and others, in which it appears that there is a direct relation between this region and the sensory tracts of the spinal cord.

The clinical evidence is also as yet very deficient. There are only two cases on record, one of these even doubtful, which indicate the sensory function of the hippocampus.

The first of these, related by Chvostek (*Wien. med. Wochensch.* 1871, No. 37–39), was a case of typhus with delirium, headache, and other cerebral symptoms. This was in 1853. Diminution of the sensibility of the left arm and leg, with formication and slight paresis remained, and at a later period paralysis agitans showed itself on the left side. Death occurred from phthisis in 1871. Section showed atrophy and sclerosis of the right hippocampus and portion of the neighbouring cortex, without other cerebral lesion.

The second case related by Claus (*All. Zeitsch. für Psychiat.* 1878, p. 335), was a case of cerebro-spinal sclerosis, in which there were paræsthesia and impaired sensibility in the upper and lower extremity and trunk. On section, along with other scleroses, there was marked sclerosis in both hippocampi.

D. Ferrier.



A Case of Athetotis.

DR. LEWIS SHAPTER.